The Builder.

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The Architectural Association Sketch-book.

THE eleventh volume of this publication quite keeps up the previous standard of excellence in the drawings and interest in the subjects. It contains seventy-two plates, of which fifty-one illustrate subjects in England and Scotland, three are from Belgium and France, one (only) from Greece, three from Spain, and the remainder from Italy. The contingent of sketches from Italy is a fair proportion, but there is room for a larger illustration of other countries in future numbers, from Greece and its neighbourhood especially, when any members of the Association are able to get so far. It is perfectly comprehensible, however, that most of those who contribute have little opportunity of going to the other end of Europe. Mr. Schultz, who has had more opportunities in this respect than many of the members, has not been unmindful of the claims of the Sketch-book; the one contribution from Greece is his, and he gives several others from Italy.

Among the English subjects illustrated we have to thank Mr. Vacher and Mr. Lewis for a valuable series of measured drawings from Westminster Abbey, six plates; Mr. Vacher alone contributes a measured drawing of a bay of the choir, with drawings of the triforium and clearstory, and in conjunction with Mr. Lewis has prepared sections of the mouldings filling three more plates. His drawing of the clearstory is a very good and boldly executed piece of work, and in regard to the plates of mouldings we may call attention to the clear and finished manner in which these are delineated. In several of the plates in which large size sections of mouldings are given, the plan has been adopted, which seems fashionable among draughtsmen at present, of edging the profile with a narrow solid black shading, one side of which of course defines the profile; the other margin of the shading just skirting along it irregularly, not parallel with the profile line, and yet sufficiently near it to look at first glance as if it were meant to be so. The effect of this is to present to the eye a number of thick ragged black marks straggling about the page; the effect is ugly, and it does not define with sufficient clearness to the eye the profile side of the shading. It is a great deal better to do as Mr. Lewis has done (for we see on looking at the signature that the mouldings are drawn by him from Mr. Vacher's full-size profiles), to define the profile by a clear and decisive black line, and then shade inside it with a tint. The matter is not one to be considered beneath notice; there have been various fashions in the way of showing profiles of mouldings, and some are distinctly better than others, both in appearance and in a practical illustrative sense. Mr. Lewis's black line is, to our judgment, thicker than necessary; the thinner the line, so long as it is a firm and even one, the more accurately can small details in the profile be shown; but it is better than the irregular black marks which we meet with on other pages. We may observe however, while on the subject, that full-size profiles are 50 per cent. more valuable than any reductions, as records; and a great many full-size profiles can be got on an average-sized page by adopting thin but distinctive lines and letting them cross each other freely. We admit that it does not make so agreeable a page to look at, and that it does not present to the eye the general proportion of parts at a glance; but it gives the precise facts in a way a reduction cannot. This is especially important in the case of the mouldings of a large and historic architectural monument; we do not say it would be worth while in the case of an ordinary small work, such as a font or a pulpit.

Mr. W. J. Tapper contributes a complete set of measured drawings, including a large-scale plan, of the interesting church of Patrington, Yorkshire, a cross church of late fourteenth century date, with the unusual feature of a transept with east and west aisles, on the same scale as the nave. The drawings comprise longitudinal and cross sections and two elevations. The treatment of the base of the spire, which rises from the middle of a thin open arcading finished above with pinnacles, is peculiar though not architecturally very admirable. The spire is a lofty thin stalk absolutely without ornament or architectural incident of any kind, another peculiarity. The page does not allow of showing the entire height of the spire; a perspective sketch showing the proportions of the whole composition would have been a useful addition; but the set of drawings is of distinct value as a record of a church which has so much individuality of architectural character.

Mr. A. H. Hart gives a series of perspective illustrations of portions of Oxford colleges: the exterior of the Dining Hall of Brasenose; the main quadrangle of St. John's, a charming bit of collegiate architecture, with its picturesque arrangement of windows; the west door of Magdalen Chapel; and the garden front of St. John's, with its characteristic oriel, in which we see late Gothic windows and mouldings supported on a classic corbelling. In regard to the west door at Magdalen, he notes the fact that the detached pointed arch which stands free, with open spandrils, in front of the square-headed doorway, has kept its form perfectly, though the horizontal door-head behind it has sunk in the centre; a curious instance of the "staying power" of the pointed arch. From the appearance of the plate we presume the original drawings were in pencil, and they seem to have been a little overshaded, which gives rather a want of clearness, except in the case of the doorway, which is on a large scale and suits the method of drawing better.

There are some interesting bits of domestic work in the English portion; among others the delightfully picturesque old Swan Inn at Knowle (Warwickshire) by Mr. Bidlake, with its wrought iron sign which sends the pictured swan flying out over the middle of the road; a piece of work which must have been a pride to the man, an artist in his way, who executed it. An old deal doorway from Carey-street, by Mr. Dods, is very interesting; still more so is Mr. Rickards's drawing of the staircase and doorway from Whittington Chambers, College Hill, E.C., shown in an excellent geometrical drawing, with the details of the joinery given. Mr. Sakurai gives a clear and well-executed perspective drawing

of the west door of Salisbury Cathedral, a little deficient in power, but commendably careful in drawing; the rather too clean and finished look of the masonry is due perhaps to the restorer as much as to the present artist. Mr. John Begg's bold pen sketch of the massive architecture of Jedburgh Abbey choir is an admirable example of free sketching of this kind; he also contributes a sheet of measured drawings of the same building, and another of measured drawings of Dunblane Cathedral. Mr. Lorimer's complete plans, elevations, and two views of Kellie Castle, in three sheets, form a good conclusion to the British series.

The one Greek illustration, by Mr. R. W. Schultz, is a most interesting coloured plate of the beautiful radiating panels of mosaic from Hadrian's Stoa, Roman work though on Greek ground, and in which something of the Greek spirit is shown in the design of the narrow centre panel, and in the outer borders, and in fact the work was very possibly executed by Greek hands, though the diaper pattern filling the larger panels is distinctly Roman in type. Mr. Gimson's drawing of some of the sculptures from the north porch of Rouen is an excellent example of pencil drawing of this class. Mr. Selby's drawing of a stained-glass window from the Laurentian Library at Florence, ascribed to Giovanni da Udine, is a very interesting contribution, printed in a light warm colour which is very suitable to the subject; this is one of the examples of that Renaissance method of stained-glass design in which figures and conventional decorative objects are painted on the plain white ground, with no connexion, and the window bars divide it up into squares irrespective of the design. Another illustration of special interest is Mr. F. Masey's drawing of the beautiful bit of inlay decoration in black cement from a tombstone in Santa Croce. Mr. T. Maclaren illustrates the charming pulpit by Matteo Civitale from Lucca Cathedral. Mr. Prentice gives an interior view of San Clemente at Rome, with a small plan attached, and also a very bold and powerful sketch of the celebrated staircase in Burgos Cathedral. Lastly we may mention a beautiful pencil sketch by Mr. Schultz of capitals in the narthex of St. Mark, which is one of the finest things in the volume.

There has been a definite attempt made in this volume of the Sketch-book to give a little more information than before in regard to the date and (where possible) the authors of the work illustrated, and a printed form has been made out to send to the authors of sketches, in which they are requested to fill up the name, subject, country, district, and date of the work, with the authority for the date, if any; and the index has been remodelled on these lines. This is a good innovation, and will add to the value of the work for the future. We may add that Mr. Pite has made a fine sketch for the title page, a half section half perspective of an imaginary Classic vaulted building of which we see part both of the interior and the exterior architecture, somewhat after the manner indulged occasionally by the architects of the Renaissance. We hope the Sketch-book will go on and prosper and even surpass its present excellence; to which end we may exhort all members of the Association who are conscious of the power of drawing well to do their best to support it.

"APULIA MONUMENTALE."—Under this title Signor Moscioni, photographer, of Rome, is issuing a fine set of photographs (some of which have been forwarded to us) of ancient edifices of Southern Italy.

PRICE OF LAND AND HOUSES IN THE CITY.—Since the auction on the 18th ult., when the vendor's bid of 160,000*l.* for the freehold of Nos. 11 and 12, Cornhill, was not exceeded, the property has been sold by Messrs. Fox & Bousfield, it is stated, at over 61*l.* per foot superficial. At the sale of four other houses, being freehold, in the same street on the 24th ult., No. 24 was sold for 23,500*l.*, or about 42*l.* 14s. 6d. per square foot; and Nos. 25, 26, and 27 for 90,000*l.*, or, say, 47*l.* 3s. 7d. per square foot.

THE STONE, CEMENT, AND ASPHALTE INDUSTRIES OF THE UNITED STATES.

THE recently-issued "Mineral Resources of the United States," 1889-90, though rather late in its appearance, contains some interesting statistics concerning the stone industry of the States. The figures apply in the majority of cases to the year 1889; in 1890 no detailed statistics were attempted to be collected, at least not on such a scale as the previous year, when the information was got together for the eleventh census report.

The value of limestone produced in the United States in 1889 was 19,095,179 dols.; the greatest amount was raised in the State of Pennsylvania—2,655,477 dols.; next came Illinois with 2,190,607 dols.; Indiana, 1,889,336 dols.; Missouri, 1,859,960 dols.; New York, 1,708,830 dols.; Maine, 1,523,499, and Ohio, 1,514,934 dols. Neither of the other States produced a million dollars' worth; whilst several fell below 30,000 dols. The principal purpose for which the limestone was used was for the production of lime, the value being computed at 8,217,015 dols. For building purposes, 5,405,670 dols. worth of limestone was used; for street work, 2,383,456 dols.; the remainder having been employed for bridges, railroad work, &c.

The value of the granite produced in the United States in 1889 was 14,464,095 dols. Of this, Massachussetts provided 2,503,503 dols.; Maine, 2,225,839 dols.; California, 1,329,018 dols.; and Connecticut, 1,061,202 dols. The purposes to which the granite was put were—Building, 6,166,034 dols.; street work, 4,456,891 dols.; monumental and decorative purposes, 2,371,911 dols.; railways, &c., 1,238,401 dols.

The total value of the sandstone produced in the same year was 10,816,057 dols. The State of Ohio heads the list with an output valued at 3,046,656 dols., the other States falling far behind; Pennsylvania gave 1,609,159 dols.; Colorado, 1,224,098 dols.; whilst New Hampshire, Tennessee, and Idaho did not produce 5,000 dols. worth. More than 65 per cent. of the whole of the sandstone raised was used for building purposes, viz.:—7,121,942 dols.; for street work a quantity valued at 1,832,822 dols. was taken up, and for bridge, dam, and railroad work 1,021,920 dols.

The value of the marble produced in the United States in 1889 was 3,488,170 dols. This was the output of ten States, as follows:—Vermont, 2,169,560 dols.; Tennessee, 419,467 dols.; New York, 354,197 dols.; Georgia, 196,250 dols.; Maryland, 139,816 dols.; California, 87,030 dols.; and Pennsylvania, Massachusetts, Idaho, and Virginia together gave 121,850 dols. A considerable quantity of marble was also imported, the value of which in 1889 was 675,415 dols., and in 1890, 785,383 dols. Italian marble, principally Carrara, formed over three-fourths of the total imports. Small proportions came from Mexico (Mexican onyx), and marbles for special purposes were derived from France and French possessions, Austria-Hungary, Great Britain, Germany, Canada, and Turkey-in-Asia.

Slate valued at 3,482,513 dols. was produced in the United States during 1889, of which Pennsylvania provided not less than two millions of dollars worth. By far the greater portion of this was used for roofing purposes, but 684,609 dols. is the estimated value of slates used for other work.

Bluestone was produced in 1889 to the value of 1,689,606 dols., the whole being quarried in the States of New York, Pennsylvania, and New Jersey. We may mention that bluestone is the name given to one of the varieties of sandstone, consisting of exceedingly small particles of silica cemented together by silica, and the special character of the material has led to its being considered apart from other sandstones. Although practically the whole of the mineral matter binding the grains together is siliceous, there is frequently a slight amount of argillaceous material present. The quartz grains are so very small, and the siliceous cement so firm, that the stone is exceedingly compact and difficult to work. As a rule it is very durable, but we imagine its quality in this respect is largely controlled by the proportion of argillaceous matter. A certain amount of the stone is raised from large quarries which regularly employ hands, and have good plant and machinery, but a not inconsiderable quantity is derived from the spasmodic efforts of men who simply provide themselves with ordinary quarry tools, and who dislodge the stone wherever it can be found. Bluestone obtained in this manner is usually transported to a number of shipping points, where it is sold to dealers who make a business of collecting irregular consignments of this nature, and shipping them to the places where the material is used. The irregular methods of conducting the bluestone industry are probably due in a great measure to the manner in which the stone occurs in nature. Many of the ledges opened up run out in a short time, and are then, of course, abandoned, so that long-continued operations at one point are not possible in many cases. Originally, bluestone was used for flagging only, to which purpose the larger portion is still applied, but now it is found in rubble masonry, retaining walls, bridges, kerbing, gutters, &c.

A large quantity of hydraulic cement is produced in the United States in 63 different establishments, situated mostly in the States of New York, Indiana and Kentucky. In 1890, 7,308,734 barrels were turned out, with a total value of 5,582,243 dols.; and in 1891, 7,607,067 barrels, valued at 5,512,153 dols. The amount of Portland cement from 18 establishments open was in 1890, 335,500 barrels, worth altogether 704,050 dols.; and in 1891, 454,813 barrels, representing a value of 1,067,429 dols. Quite one-half of the cement sold at Buffalo and points west of that city is in sacks. All cement sold in Buffalo, and west of it, is rated at 265 lbs. per barrel, whilst all sold east of that place contains 300 lbs. to the barrel, and Portland cement, 380 lbs., so that there are three different weights for a barrel of cement in the United States—a very convenient arrangement in the hands of some people, no doubt. The fact that Portland cement is frequently said to do better on the other side of the Atlantic than the natural cement, may be in some cases due to the fact that one-third more of the material is given to the barrel.

The production of asphalte and its ally, bituminous rock, was limited to California, Kentucky, and Utah in the years 1889-90. Ohio produced also 600 tons in the latter year, but it was not sold. The varieties, qualities, and values of the several bitumens are so widely different that they might readily be classed as separate minerals. In fact, a new name is usually given to each new discovery. During 1889, 51,735 short tons, valued at 171,537 dols.; and in 1890, 40,841 short tons, worth 190,416 dols., were turned out. It is noteworthy that prior to the year 1888, the output was entirely from California, and the industry had hardly assumed commercial importance. In 1887, for instance, only 4,000 short tons were chronicled, but in the following year, when Utah also began to yield the material, the output suddenly increased to over 50,000 short tons. Notwithstanding the large proportions which the asphalte industry has attained in the Western States of America, the bulk of supply for the United States, in fact nearly all that is consumed in the Eastern cities is procured from the island of Trinidad, in the West Indies. This is mainly due to the excessive cost of transportation from the Western localities. The area laid with Trinidad asphalte in the eleven years, 1880–1890, was 6,803,054 square yards, which is equivalent to 446 miles of roadway 26 ft. in width. A limited amount of asphalte from Neufchatel, Switzerland, is also imported into the United States.

NOTES.

AS the St. Pancras Vestry did not trouble themselves to give us any official notice of the exhibition of the competition designs for their proposed new offices, we presume they concluded that we should hardly think the collection of much interest, and we are quite disposed to agree with them. The average merit of the designs, in fact, is what we must expect to find in a vestry-hall competition as long as superior architects have so little faith in the manner in which such competitions are likely to be conducted. The first premiated design, by Mr. W. Harrison, is one of the best; we do not know that we should conclude it was the best. The plan is compact and economical, at the cost of being rather wanting in clearness and symmetry of arrangement; but the Council-chamber and committee-rooms are placed on the second floor, which we should call a very inconvenient arrangement. The elevation is unobjectionable in point of taste; we fear more can hardly be said. The second place is given to Messrs. Gibson & Russell, whose plan has more of internal effect and symmetry, but spends a rather large proportion of space on corridors, and the committee-rooms and Council-rooms are too much spread out on the first floor, and not sufficiently concentrated. The architectural treatment is effective, and the building would have been a picturesque one in execution. We hardly think so much could be said for Messrs. Malcolm Stark and Rowntree's design, to which the third premium has been awarded, but the plan has a good deal of merit, especially in the arrangement of the ground-floor offices. Among other designs exhibited (taking them in order of hanging) there is artistic feeling and picturesqueness in the rather odd elevation by Mr. F. W. Dixon; Mr. J. Johnson's is a very neat-looking and decidedly "vestry-hall" elevation; Mr. P. J. Marvin sends a simple brick elevation, with hardly any decoration but a sculptured frieze under the eaves, which is in very good taste; Messrs. Hall & Ardron (we presume—spelt "Ardroan" in the printed list) have laboured hard on a carefully-prepared set of plans and elevations, showing a front of considerable dignity and effectiveness; Mr. Worley's design has picturesque elements; Mr. H. Wightman Rising sends a quiet and tastefully-designed Queen Anne elevation; Messrs. Tulloch & Dennis send a bold design in round-arched style, with sculpture introduced in the spandrels of the upper windows, and a tower rather too large for the occasion, but the whole design has dignity. With these exceptions, we may say that considering that there are sixty designs sent in, and that the building (to cost about 30,000*l.*) is a tolerably large and important one, we have seldom seen a poorer set of competition designs, many of them looking like the efforts of pupils rather than those of practised architects.

THE Education Department has made a move in the right direction by drawing more attention to the sanitary state of elementary schools. That these places should be in a proper sanitary state is important in the highest degree for the health of scholars and of teachers. In the next place, when the importance of this fact is brought home to the persons who are managers of these schools, and to School Boards, it is likely to add to the general appreciation and knowledge of sanitary principles. From the first of the month inspectors are to fill up a form at their annual inspection, which will give the Department particulars of the sanitary state of every elementary school in the kingdom, and it will in time form a complete statistical record of the condition of school premises. It is to be regretted that no machinery exists for obtaining similar information in regard to higher grade schools, or of compelling higher grade schools which are deficient from a sanitary point of view to amend their ways. When the Education Department make their report, after the first year's experience of the new system, some interesting facts from a sanitary point of view are likely to be made public.

AT the Mansion House Conference on Monday, Sir James Whitehead and his Railway Rates Association, received the unanimous support of a host of M.P.'s and others holding widely different political views. The meeting was a thoroughly representative one, and was described by the Lord Mayor as the most important of its kind ever held at the Mansion House. The sympathetic reception of the agriculturists by the President of the Board of Trade the previous week doubtless encouraged the promoters to submit strongly-worded resolutions,—all of which were carried with the greatest enthusiasm. The Association has always been pretty active, though hitherto it has mainly stood on the defensive. At Monday's meeting, however, Mr. Barran, M.P., accurately designated the proceedings "a declaration of war,"—a statement emphatically endorsed by those present. The justification for this attitude is to be found in the fact that the railway companies obtained Parliamentary sanction for their maximum rates largely on the faith of the assurance,—again and again repeated,—that they had no intention of raising their rates, although a complete revision might be found necessary. It is argued,—and, we believe, cannot be denied,—that the revised charges are almost invariably based upon the new maxima; and the re-adjustments and "concessions" which are gradually being made afford a proof that it is necessary for traders to make use of the strongest pressure possible, or be saddled at once with charges only intended to be held in reserve against emergencies. Mr. Channing, M.P., said that the rates just issued have defeated the intention of recent legislation, while Mr. Barran declared that Parliament would be willing to follow the lead of that meeting, an assurance which was upheld by an encouraging speech by Mr. James Lowther, M.P., and sympathetic utterances by other speakers. The lead of the meeting was drastic enough, a resolution being carried urging the prompt passing of an Act "for so extending the powers conferred upon the Board of Trade as to give them jurisdiction in cases of complaint or dispute to determine what an actual rate or charge shall be." The railway companies might fairly denounce this as constituting an unwarrantable interference with their business; but it must be admitted that the traders may quite as fairly point to the treatment they have just received at the hands of the companies, as justifying them in seeking further protection.*

IT was inevitable that the deputation which waited upon the Chancellor of the Exchequer on the Decimal question should receive but slight encouragement; otherwise Sir William Harcourt's utterances would have been decidedly disheartening. The difficulties connected with the change are as apparent and undeniable as are the benefits which would ultimately ensue, and Statesmen are confronted with too many other important questions to attempt to grapple with one which would meet with hostility from a large section of the community. It cannot but be regarded as extremely unfortunate that each successive Government should feel compelled to throw cold water upon the efforts of the Decimal Association, tempered as it generally is with a sufficient amount of sympathy with the objects of the Association to prevent its being too chilling. Of course in any scheme for revising our coinage, the pound sterling would remain the standard, but several writers boldly propose the abolition of the penny. The latest suggestion,—in last month's *Westminster Review*, — assumes that the public would submit to the substitution of "half-groats" and "mites" for pence and farthings. The half-groat would be worth one-tenth of a shilling, and "as a safeguard" the proposer would "strictly forbid the application of the term 'penny' to the new half-groat." Sir Wm. Harcourt considers that it is as futile to think of interfering with the penny as it is with the pound sterling. He insisted upon looking at the question as a practical one, and not a theoretical one, and argued that no inquiry would do more than establish the sound theoretical advantages of the system. With this the deputation had to be content for the present, but we doubt not that the Association will persevere with their commendable efforts to bring about the desired change.

THE Board of Trade Returns for the year show that our imports of materials used in the building trade are still increasing, while our exports are diminishing. Of wood and timber, we imported in 1892 the following quantities:—Hewn, 2,469,140 loads, valued at 4,905,846*l.*, against 2,251,577 loads, valued at 4,508,787*l.*, in 1891; sawn or split, planed or dressed, 5,094,309 loads, valued at 11,180,141*l.*, against 4,378,452 loads, valued at 9,379,808*l.*, in 1891; staves of all dimensions, 136,063 loads, valued at 593,539*l.*, against 130,101 loads, valued at 590,543*l.*, in 1891; mahogany, 56,315 tons, valued at 501,213*l.*, against 48,021 tons, valued at 449,433*l.*, in 1891. It will be seen that the increase in the imports of wood in a more or less worked condition is far greater than of wood and timber in the hewn state. For the latter the increase was 715,857 loads (nearly 16½ per cent.) and 1,800,333*l.* (over 19 per cent.) respectively; for the former, 217,563 loads (over 9½ per cent.) and 497,059*l.* (over 11 per cent.) respectively. Our chief sources of supply of hewn wood and timber are still Sweden and Norway, Russia, and "other countries"; of the material in the more advanced state, Sweden and Norway, Russia, and British North America. The imports of iron manufactures (girders, beams, and pillars, large quantities of which are used in the building trade) amounted to 74,586 tons, valued at 502,574*l.*, in 1892, against 74,035 tons, valued at 509,880*l.*, in 1891. While the quantity was slightly larger, the value somewhat declined. There was a further increase in window and German sheet-glass and plate-glass, the imports of the former being 993,117 cwt., against 855,332 cwt. in 1891; of the latter, 212,159 cwt., against 175,793 cwt. The value of window and German sheet-glass rose from 490,535*l.* in 1891 to 564,231; but that of plate-glass, notwithstanding the larger quantities imported, fell from 338,669*l.* to 334,303*l.* Turning to exports of building materials, we find that there was a decrease in almost all descriptions. Our chief exports consisted in painters' colours and materials, of which we shipped goods of the value of 1,524,600*l.*, against 1,617,318*l.* in 1891; decrease 5·8 per cent. Next follows cement, the exports of which were 493,128 tons, valued at 902,599*l.*, in 1892, against 575,969 tons, valued at 1,140,697*l.*, in 1891. In this material the decline was thus 14½ per cent. in quantity and nearly 21 per cent. in value. Our exports of plate-glass also show a considerable decrease, from 3,284,513 square feet (valued at 212,422*l.*) in 1891 to 2,158,046 square feet (valued at 116,569*l.*) in 1892, or over 34 per cent. in quantity, and over 26 per cent. in value.

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* In several industries it has been found that the railway companies have effected advances in their charges by means of alterations in the computation of weight. It appears that the increased charge upon Portland stone is due largely to this: the stone being now reckoned at 14 cubic ft. to the ton, instead of 16 cubic ft. as formerly. The quarry owners are memorialising the railway companies with a view of getting the old conditions restored, and appeal to builders, and others interested, for support. Messrs. Webber & Pangbourne, of the Eastern Works, Portland, have the matter in hand, and invite signatures to the protest they have prepared. If, as we understand, 14 ft. of stone does not weigh a ton, the railway companies have taken up an an untenable position, and there should be but little difficulty in obtaining the desired relief.

A CORRESPONDENT calls attention to the very bad lighting of the stations on the Underground Railway. There is no doubt this is a just cause of complaint on the part of the public, and it is an instance of the disregard of the public convenience which characterises some railway companies. The underground stations should certainly be lighted by electricity; even, however, if they are lighted by gas, a little care would enable the stations to be better lighted than they are at present. No attempt is now made by means of reflectors to illuminate the platforms. The power of the gas-jets is wasted above the heads of the passengers. Neither the Metropolitan nor the Metropolitan District Railway is financially a success, and, therefore, the public must expect them to be economical. But true economy consists in making the most of materials at hand, which is certainly not at present done by either of these companies.

RANKINE'S theory and formula as to foundations in loose soils, which was based on the modern theory of granular masses, seems to be called in question by the results of some calculations and experiments by Professor V. J. Kurdjümoff, which are detailed in a recent number of *Der Civilingenieur*—which go to prove that Rankine's formula must be accepted at least with reservation. Another worker in this field of research has been Pauker, whose theory is based on the mutual action of sliding and resistance prisms, but this also is attacked by Professor Kurdjümoff's investigations; as the former assumed the resistance and sliding prisms to have plane slide-surfaces, whereas the latter are curved; nevertheless Jankowski's modification of Pauker's formula gives results which fairly agree with experiment, although based on assumptions not strictly correct. Rankine's formula is said to fail because it involves the false assumption that the difference in the pressures on two adjacent elements can be finite. In support of the theoretical reasoning put forward by Kurdjümoff—in which he shows that the slide surfaces are probably defined by continuous curves starting vertically from the edges of the foundation, passing under the latter and out to the surface of the ground at the opposite sides—an apparatus was designed by means of which it was sought to determine the actual form of the slide surfaces. A box, having a glass slide, was filled with sand, and a rectangular block of wood was pressed down on the sand by a screw and guided in so that one side touched the glass. A section of the material was thus exposed, and records were obtained by photographing with magnesium light; the sand, it should be stated, being arranged in different colours. When the pressure was exactly vertical the sand gave way on both sides of the block, and the curves of the slide surfaces were symmetrical with respect to the vertical axes, starting from the middle of the foundation. With an increase in the depth of foundation, the outer portions of the slide curves became steeper, so that the width of the prism of the disturbed material measured perpendicularly to the sides of the block was not proportional to the depth of the foundation nor to the resistance. When the pressure deviated to a certain extent from a vertical direction the disturbance of the sand sometimes occurred on one side only. By giving various slopes to the surface of the sand the form of the slide curves was correspondingly modified. The curves were also affected by a difference in the height of the surface on the opposite sides of the block. In the latter case the author arrived at the following rule:—"The width of the displaced prism is inversely proportional to the depth of the foundation on either side." A vertical wall, in close proximity to the block, was found to increase the resistance of the foundation, and to act in a manner similar to a difference in the height of the surface on opposite sides of the block.*

IN the last issue of the *Bulletin de Correspondance Hellénique* (vi.-vii., 1892), Mr. Maurice Holleaux publishes the very interesting series of bronze *plaques* found in the excavations at the sanctuary of Apollo Ptoïos. These bronzes, though found some years ago, have hitherto only been made the subject of brief notices in reports. Six of the thirteen fragments published contain decorative motives only,—*e.g.*, heraldically-arranged sphinxes, griffins, birds, &c. The remaining subjects are divided between *genre* and mythology. These last are of great interest. One fragment represents the subject—hitherto rare in art—of the combat between Zeus and Typhon. Zeus strides forward, with his thunderbolt uplifted, to attack a colossal winged monster. Another fragment represents Prometheus attacked by the vulture. Obviously, as a glance both at style and subject shows, we have here a close analogy to the archaic bronze reliefs of Olympia. On one of these, it will be remembered, a fragmentary inscription is still legible, and the letters show that the work must have been executed somewhere in the neighbourhood of Sicyon, Corinth, and Argos. From this same district must have come also the analogous reliefs found at Dodona; and, finally, the present specimens from the Ptoïon, in the north of Bœotia. Their discovery evidences the widespread influence of the Argive-Corinthian school of metal-working.

THE November number of the "Transactions of the American Society of Civil Engineers" contains a paper dealing with the subject of thin floors for bridges, in which the author reviews at some length Mr. Olander's paper upon the same subject, read before the Society of Engineers in March, 1887, and provides some practical transverse sections of bridges showing successful methods of constructing railway bridge floors, in cases where it is undesirable to raise the rail level and where the headway required for the under-passage or roadway necessitates a limited thickness for the rail-floor. In a paper upon "Railway Signalling as Applied to Large Installations," Mr. R. C. Rapier's paper upon the "Fixed Signals of Railways," read at the Institution of Civil Engineers, March, 1874, is alluded to, and the value of the interlocking tappet specially dwelt upon. The author's recommendation for signalling is to eliminate the human agency as much as possible. Another author in a paper upon Electric Rock blasting, argues that the fuse cannot at best be as safe as the electric blast, and that the reliability of batteries as generators renders electric blasting preferable to the process of simply igniting a fuse leading to a cap which is inserted in a cartridge. In a discussion on motive power for street railways, the electric motor is stated to be wasteful, unsightly, and not entirely reliable, while cable traction is asserted to be advantageous and successful. The volume closes with a discussion upon pile-driving, in which regret is expressed at the want of uniform practice by engineers and contractors in this branch of engineering. The result of rapidity of blows for penetration is presented. Errors derived from investigation with ordinary sounding rods are emphasised, and very proper remarks made upon the mistake of using piles to support both vertical loads, and in addition to be expected to act as retaining walls when unanchored or not held back by bracing.

THE third and last of Professor Silvanus Thompson's lectures at the London Institution, on electric lighting, dealt with systems of distribution, meters, and other accessories. The series, parallel, three-wire, and transformer systems were explained with the help of diagrams; their history briefly indicated, and the circumstances pointed out which determine the suitability of each. The Professor then explained in some detail the combination of transformer and three-wire systems adopted by the City Lighting Company, and illustrated it practically by a Mordey transformer, placed on the floor, and a bank of lamps, with the three "leads" from the transformer, on the wall behind the lecture table. Just touching on distribution by storage batteries, the lecturer passed to the consideration of meters, which he treated with characteristic humour. He was so often asked, he said, whether there existed a "reliable" electricity-meter that he proposed having a card printed, "There is not yet a 'reliable' gas-meter." The electricity-meters now in the market were, he maintained, ten times more reliable than any gas meters. Proceeding to details, he then explained the principle of a number of meters, proposed or actually in use, beginning with Edison's electrolytic cell, which, he said, was obsolete, owing to certain objections to it in practice; and going on to the Aron meter, invented by Messrs. Ayrton & Perry, with its differential gear; Hopkinson's motor meter; the Ferranti direct current meter; the Shallenberger, which was shown in action, measuring the energy consumed in lighting the theatre; Elihu Thomson's meter for alternating currents and a new form of self-winding clock-meter, in which for differential gear there was substituted the device of having the hands of the clock driven by one gearing, and the face by the other. From measurement of electric energy to its cost was a natural transition, and to the best way of reducing the cost by daylight use of the plant for purposes other than lighting. The practicability of this was shown by a motor driving a fan, and a number of utensils lent by Messrs. Binswager for heating and cooking by electricity were exhibited. Finally, the audience were dismissed to the strains of an ordinary piano played by some mechanism which was driven by an electric motor; an application which the lecturer said he could hardly recommend as an "all day load." Professor Thompson, we may add, is almost the ideal popular lecturer; he is fluent, and never at a loss for a word; he seems instinctively to take the measure of his audience, and to know exactly how much to tell them; and has the art of making what is trite seem new, and what is complex, simple.

A NEW antiquarian magazine, to be published quarterly under the title of the *Illustrated Archæologist*, is announced to appear on May 1 next. It will be edited by Mr. J. Romilly Allen, and its special feature will be illustrations, which will be the main object, the letterpress being merely descriptive of the illustrations.

THE series of pictures by Mr. Ayerst Ingram, now being exhibited at Messrs. Dowdeswell's under the title "A 'P. & O.' Voyage," have an interest apart from their artistic merit. The idea of illustrating a voyage in this way is a very happy one, and might be further applied. We get the scenery of the various coasts that are passed in succession, the knocking about of the big steamer in "the Bay," the slow progress between the low sandy banks of the Suez Canal, the deep blue water of the Indian Ocean, the white buildings of Sydney under the bright sun, one after another, in a way that makes one almost realise the voyage, as well as some of the incidents of steamboat life. Many of the sea-pictures are admirable in themselves, apart from their place in the story.

* Investigations on this subject have also been carried out by Forchheimer, a brief description of which may be found in the minutes of proceedings of the Institution of Civil Engineers, vol. lxxii., p. 331.

THE miscellaneous collection of paintings on view at the Fine Art Society's Gallery contains some good things, and is worth a visit. Among the small works are some of architectural interest, such as Signor Giampietri's powerful representation of the arch of S. Severus, Rome, and Mr. Cotman's little views of Pinner and Rainham streets. In Mr. Albert Goodwin's Tewkesbury, a charming little landscape, the tower in the distance does not give a correct impression by any means of Tewkesbury Tower; we should not have recognised it.

A CURIOUS sample of the inaccuracy and indifference of daily papers about architectural matters (so long as they can have a fling at architects) is exhibited in a paragraph which originated with the *Daily Chronicle*, and is now getting industriously copied in provincial papers. This states that the violent attack on the architectural profession in the *Edinburgh Review* is one of the best things that has ever appeared in that periodical, and that it is probably from the pen of Lord Grimthorpe! The article is in the *Quarterly Review*, and Lord Grimthorpe is one of the persons attacked in it, though his name is not actually mentioned; one of his tracery windows at St. Albans being illustrated as "the horrid example." The person who wrote the paragraph cannot even have read the article; but anything in the shape of abuse of architects is always good "copy" for the average daily paper.

LETTER FROM PARIS.

WE mentioned a few months ago the case of the sculptor Lecreux, better known under his pseudonym of "Jacques France," who, having in vain endeavoured to popularise a very ugly bust of "La République," in a fit of fury stabbed the expert who had been appointed to examine into his claims. Thanks to the ability of his counsel, "Jacques France" has been acquitted after passing ten months in prison. The jury took the view that he was not in a state of mind to be entirely responsible for his acts. In fact, the sculptor in question is a very poor creature, the victim of a vocation for which he had no real ability, and of his own exaggerated vanity. The incident is fortunately a rare exception; there is plenty of painful struggle for life among the ranks of French artists, but disappointment is in general accepted silently and with dignity.

M. Pierre Vauthier, who has been commissioned by the Municipality to prepare a series of views of Paris for the Chicago Exhibition, is an artist eminently qualified for such a task; perhaps no one is better acquainted with all the picturesque corners of the city, and his pictures, after filling a place in the exhibition, will have a certain permanent value as historic records. The pictures which he has painted represent the Avenue de l'Opéra, the Halles, the Place de la République, the Boulevard des Italiens, the Quai aux Fleurs, the Pont d'Austerlitz, &c. All the pictures, now being exhibited at the Georges Petit Gallery, are fine and clear in lighting and effect, and do great credit to the painter.

The exhibition of the works of two Japanese artists, at the Durand Ruel Gallery (already referred to in our foreign notes), MM. Antomaro and Hiroshighé, has proved very popular with the Parisians. The paintings are vividly realistic in effect, and show great ability and variety of execution.

The small exhibitions continue to succeed each other. The "Cercle de la Rue Volney" has just organised its annual exhibition of paintings, and if we pass over the works of some amateurs who are only too happy to exhibit side by side with well known masters, the exhibition is noteworthy for the number of good portraits and landscapes. Among the former is an admirable portrait of Mdlle. Rachel Boyer, by M. Benjamin Constant; M. Bouguereau exhibits a "jeune fille au papillon," faultless in drawing, and M. Henner a curious study; among other exhibitors are MM. Bergeret, Berthelon, Boucher, Damoye, Jules Lefebvre, Henri Martin, Rixens, Vibert, and Yon.

M. André Sinet, the pastelliste, who has become in his way a fashionable portrait-painter, has collected some of his recent works in the "Galerie des Artistes Modernes," in the Rue de la Paix. It is a collection of very conventional pictures, but showing a great deal of facility and spirit, and is at all events very popular with the Parisians.

Sixty years ago, in 1832, a group of artists, among whom were Decamp, Ary Scheffer, David d'Angers, Robert Fleury, Isabey, Delaroche, and others, petitioned King Louis Philippe that the annual exhibitions of pictures should take place in the months of September and October instead of in May and June. The petition was unsuccessful, although it was not then the fashion, as it is now, to quit Paris at the end of June and not return till the end of October. At the present time, that which is called the "grand public," or "tout Paris," departs immediately after the "Prix de Paris." It is difficult therefore to understand the action of a certain number of members of the Société des Artistes Français, who are again moving to have the Salon relegated to September 1st as its opening day. Their argument is the difficulty of preparing pictures during the colder and darker months of the year; but it is not likely this attempt will prevail against the general fashion and the increasing taste of the Parisians for country life at that time of the year.

The sites proposed for the exhibition of 1900 are still under discussion; one project succeeds another, but nothing like a decision has been arrived at. The proposer of one of these schemes, M. Saint-Lanne, has commissioned two able decorators, MM. Hista and Chaperon, to execute a model showing the immense agglomeration of buildings which he proposes to construct behind the Auteuil viaduct, on both banks of the Seine, and which will cover about 150 acres. Taking the river as a base, M. Saint-Lanne places upon it a bridge terrace of enormous proportions, the four towers of which will be connected with the palace of electricity, and with a "Tour Ville," in 45 stories, to contain two thousand apartments, a theatre, a bathing establishment, gardens, restaurants, &c., on the right bank, and on the axes of the terrace will be a "Place des Nations" 400 mètres in length by 200 in width, abutting on the Palace of Electricity, to be built in steel, and of which the highest lantern will overtop the Eiffel Tower. At the centre of the Place is to be a state pavilion, around which will be grouped the foreign exhibition departments. On the left bank will be the pavilions of Machinery, Industries and Transport, the Agricultural exhibition, the Colonial and Ministerial exhibitions. Such is the project, of which we give an account as a curiosity, and without the least belief in its accomplishment, considering the restricted and economical ideas of most of the members of the organising committee appointed by the Government.

By the side of these discussions for a celebration which would form a bond of union between France and other nations, our press is preoccupied with certain more bellicose subjects, and is pressing on the Government the consideration of the danger which the dome and campanile of the church of Sacré Cœur might prove in time of war, as marks to guide the enemy's artillery. The fact is that the subject of a second siege of Paris is merely a pretext that has been invented by those who have all along been endeavouring to prevent the completion of the church on Montmartre. However, slow as its progress has been, and in spite of the death of its lamented architect, the work has gone on, and since the visit of the Congress of Architects two years ago considerable progress has been made, and the cupola of the choir may be expected soon to emerge from its scaffolding. An absurd rumour that the Council of Defence of Paris had given orders for the removal of the church and the erection of a fort on the same site may be traced to the same influence, and is absolutely without foundation.

The jury of architecture of the Académie des Beaux-Arts, under the presidency of M. Ginain, has been occupied with the decision on 140 designs sent in for the Godebœuf prize, the subject being "A Fléche." A First medal has been awarded to M. Rigault, a pupil of M. Guadet, and Second medals to MM. Selmersheim, Bigot, and Avard.

M. Hector Lemaire, the sculptor, has been appointed professor at the Ecole Nationale des Arts Decoratifs in place of the lamented Moreau-Vauthier, whose death was briefly announced in the last number of this journal. Moreau-Vauthier was an artist of great and rare talent. He was the son of a dealer in ivory, and studied in that material under the sculptor Toussaint. His first works in decorative art received awards at the Exhibitions of 1855 and 1867, and the marriage coffer which he executed in 1857 for the Baronne de Rothschild was much admired. He was the author also of a great many well-known pieces of sculpture, his "Petit Buveur" exhibited in 1869 is in the Luxembourg, his "Nereide" in marble adorns the apartments of the Prefect of the Seine in the Pavillon de Flore. We may also mention his bronze statue "Un Pâtre Italien," his "Bethsabée," a marble statue; his stone figure of Ste. Géneviève, and the bronze statutes of "Jeune Faune," "Pascal Enfant," and "Gavroche." His "Un Prevôt des Marchands" has been recently purchased by the municipality, which intends to acquire various works in ivory, onyx, and silver, for the Galliera Museum.

M. Paul Peraire, landscape painter, has just died in Paris at the age of 63. He was a native of Bordeaux, and studied under the direction of Eugène Isabey and Luminais. Since 1866 he had exhibited every year, at the Salon, landscapes principally of scenes in the outskirts of Paris. Among his recent works may be mentioned "Les Environs de Corbeil," purchased by the State in 1890, and his last picture exhibited in 1892 at the old Salon, "Un Coup de Vent," also purchased by the State.

The sale of the Spitzer collection is definitely announced to commence on April 7, in the Hôtel No. 33 in the rue de Ville-Just, and will go on till the 16th of June.

WHAT IS ARCHITECTURE, AND HOW CAN IT BE ADVANCED?*

BY PROFESSOR AITCHISON, A.R.A.

I HOPE I made it clear that the distinguishing character of architecture as compared with mere building is giving the true character to the structure, and that this character is to be got by making the shell perfectly fitted for the occupants by using the materials properly, and by making them strictly conform to the laws of statics.

The fitness is only to be got by knowing how the occupants employ themselves, and adapting the shell to such occupations; and I now speak of a single shell, perhaps the rarest thing to be found in a civilised country.

In 1848 I saw a Welsh cabin: it was round, with one low opening which acted as door, window, and chimney; and the shepherds' huts of the Roman Campagna were not unlike it, but bigger. The peat smoke in the first was too stifling to let me stay till I could see what the inside was like, and I don't recollect even entering the other.

This circular shape was possibly due, in the first instance, to the ease with which the branches of trees can be fixed into the ground in a circle, their tops bent and tied together to form a roof; they were then wattled, and the roof was mostly thatched. Even now if we had nothing to build and roof with but rough stones, we should probably build the shell like the Treasury of Atreus at Mycenæ. I merely speak of these as a type of forms suggested by the ease of making them, and by no means as a type of the forms produced by the wants of more civilised occupants.

The fitting a single shell for its purpose would give the outside form, and would vary as the occupants had more wants and the builder more skill. A hut, if it were to contain many persons, and had no chimney, would in rude times naturally take a circular form, the fire being in the middle, and the smoke going out at a hole in the top, for the occupants would naturally form a circle round the fire; but directly indoor occupations were followed, the hut in northern countries would want windows.

Modern houses,—and, in fact, most buildings,—are an aggregation of separate shells for different purposes, and should be arranged separately before being put together; and then the requisite passages for getting from one shell to another, and the requisite staircases for getting from one story to another, should be arranged.

The next consideration must be the material of which the house is to be built; for present purposes, the material might be wood, brick, rubble, or large stones; with wood or large stones for the material the openings would be spanned horizontally with timber or a large stone; but if the house were built of brick or rubble the window openings would be arched.

Let us take, as an example of modern commonplace architecture, a warehouse for the storage of some one sort of raw material, to be built of brick, some stories high, and floored and roofed with wood.

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* Being the second Royal Academy Lecture on Architecture this Session. Delivered on Thursday evening, January 26.

We must either let the eaves overhang, to take the rain from the building, and to protect the walls,—and such roofs are not easily repaired,—or we must have gutters at the back and front and gable ends. As, after a time, all gutters leak, we must arrange them so as to be clear of the walls, and defended by a parapet; to do this we must corbel out at intervals and arch between, which gives a natural cornice. If the depth of the warehouse and the weight of the goods on each floor were not too great, we should joist from wall to wall.

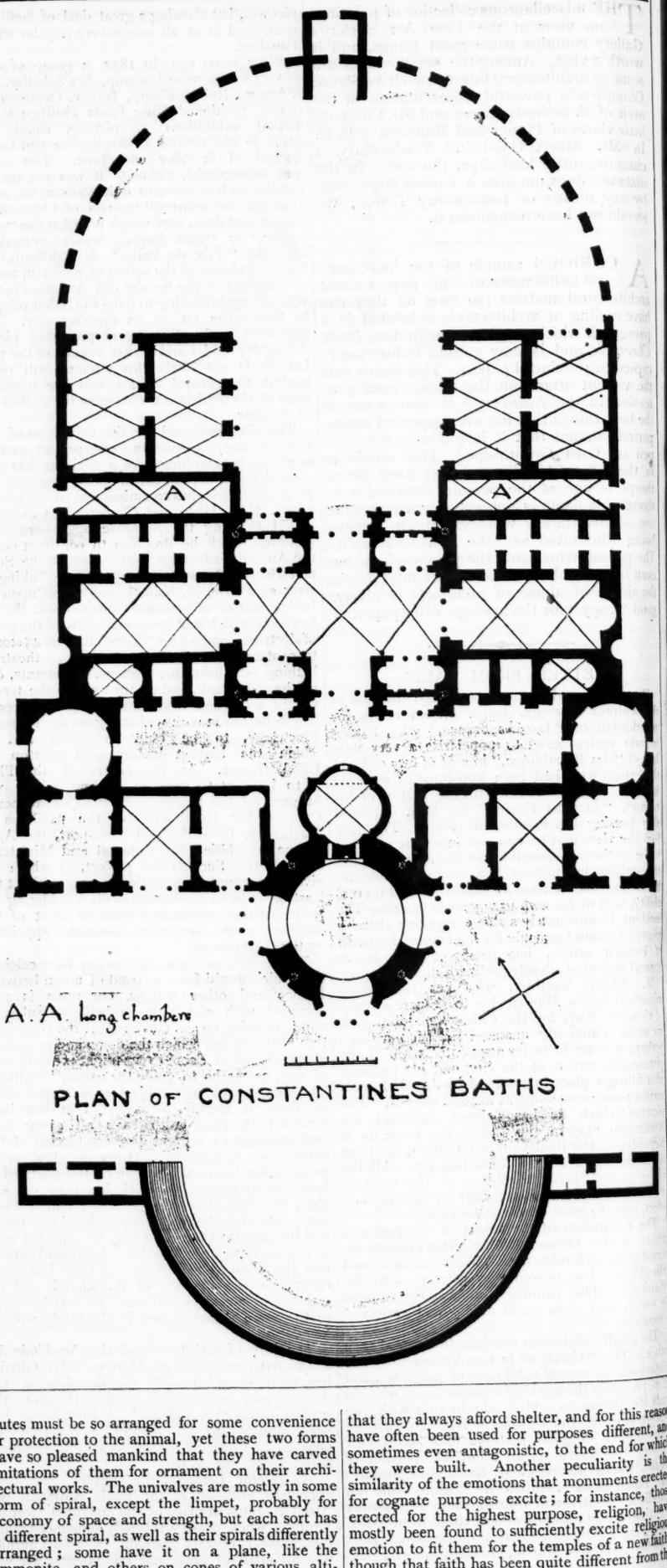
The long wall of the top story would only carry half the roof, but the one below would not only carry half the roof, and the wall of the story above it, but half the load on the floor; and that of the lowest story would carry half the roof, all the wall above it, and half of all the load; consequently the wall of each story requires to be thicker than the one above, and as we should naturally place the thinner wall in the middle of the thicker, we have a set-off on both sides of the wall on each story. The drifting rain would lodge on the outside set-off, and sink into and destroy the wall; so we have to cope it with a projecting and throated coping, which forms a string, to prevent this and to prevent the wet from dribbling down the face. Below the cornice we have therefore as many strings as there are stories, and we want some kind of footing to the walls to distribute the load on to the earth; we want windows for light and ventilation, and the window openings must be arched over; but as the inside face would take not only the weight of half the wall, but the principal part of half the load, we should want the inside arch deeper than the outside, and consequently we should get a stepped arch. Besides the features already described, we want one or more ranges of loops for the reception and delivery of goods, a staircase to get to the stories, and probably an office for the accounts and payments, each involving a different size and situation for its windows. Warehouses are not generally built in uninhabited plains, so the owner should not be allowed to destroy the prospect of his neighbours, as well as their light and air, without giving them something which may give some interest and pleasure to the beholders.

I cannot help thinking that the ultimate shape of inhabited architectural monuments will be mainly due to the proper arrangement of the building, and to the materials with which it is built, though something must be dependent on the way that emotions are expressed. The parts will take their shapes from the strains they have to bear. We shall, I think, find out these shapes partly by theory, and partly by experiment, in all the materials we use; and the forms will be different when they are used in compression, tension, or cross strain, and these shapes will probably be different for brick, stone, concrete, wood, or iron. For stone piers that have but one uniform pressure to bear, we shall find, if we have not found, the proper shape by analysing the strains or pressures, and seeing by experiment what can be cut away. We shall also find by the same methods what shape the pier will take if it has many and various pressures: take, as an example, the nave pier of a Mediæval cathedral; it has one main vertical stress or strain from the roof, the solid wall of the clearstory, the triforium, and the nave; two from the main primary wall arches with their loads; two from the secondary arches with their loads; one from the cross or transverse ribs of the vaulting of the nave, one from that of the triforium, and one from that of the aisle; two from the diagonal ribs of the aisle; and two from the same ribs of the triforium; and finally, two from those of the nave. If, in the first instance, the pier were square, it would be found by calculation or experiment that certain portions of the stone could be safely cut away, but at present we have no notion of the form that would be left, and the same would happen in a stone or brick arch. The S Curves that the angle piers of the nave and transept have taken in most Mediæval cathedrals show that the thrusts have not been properly abutted, but in this stage of the inquiry that is a minor consideration; the question is, whether the forms chosen are the proper ones? A column is not, I think, a form to suggest the abuttal of thrusts, for these compound columns, besides bearing downright stress, have to resist the inward thrust of the transverse and diagonal ribs of the aisles and triforium, and the outer thrust of the similar ribs of the nave vaulting, as well as the downright weight.

To go back to my former simile of the shell-fish, the cockle and the scallop are both fluted, but differently; they are both slightly different in shape, and both have their flutes radiating in a slightly different way. These shapes and these flutes must be so arranged for some convenience or protection to the animal, yet these two forms have so pleased mankind that they have carved imitations of them for ornament on their architectural works. The univalves are mostly in some form of spiral, except the limpet, probably for economy of space and strength, but each sort has a different spiral, as well as their spirals differently arranged; some have it on a plane, like the ammonite, and others on cones of various altitudes, while some again have the mouth branched, evidently for legs or feelers, and these shapes are not to amuse or delight us, though they may do so, but to give the accommodation and protection most needed by the creature.

One peculiarity of architectural monuments is that they always afford shelter, and for this reason have often been used for purposes different, and sometimes even antagonistic, to the end for which they were built. Another peculiarity is the similarity of the emotions that monuments erected for cognate purposes excite; for instance, those erected for the highest purpose, religion, have mostly been found to sufficiently excite religious emotion to fit them for the temples of a new faith, though that faith has been quite different from the one it has superseded.

The pagan temples were used by the Christians as churches, possibly by the Moslems as mosques. The buildings on the Acropolis of Athens were first used as pagan temples, then as Christian churches, and then as residences by the Turkish



PLAN OF CONSTANTINES BATHS

governors. Possibly other temples were used as mosques, for the Saracens certainly used the Christian churches as mosques almost without alteration, and those secular buildings, the Baths of Diocletian, are still used as a Romish church, while the Christians use the mosque at Cordova as a cathedral.

This at least shows that there was nothing repugnant to a new creed in the architectural expression of a former one, and that the sublimity of merely secular buildings produced the emotions desired in ecclesiastical buildings, as we also see in the basilicas. We might think that the Romanesque and Byzantine ecclesiastics were indifferent to the emotional aspect of the buildings, one set belonging to an undeveloped people, and the other to a decadent one, and that each set of ecclesiastics thought no more of the emotion produced by the monuments than the ants of Alexandria did of the hieroglyphics on Cleopatra's Needle, when they made them the floors and walls of their dwellings or the streets of their cities; but this could hardly be the case with the Saracens, who would certainly have levelled them with the ground, if they suggested any antagonism to Islâm.

Man is a peculiarly imitative animal, and when he finds a building that a superior nation has used for any purpose, he mostly makes his own in imitation of it, if the altered circumstances will allow of it; hence the arrangement of the Roman house, at least in some warm countries, is still adhered to. The gilded halls of the Romans became the gold parlour of the abbeys, whose window still hears the name of oriel.

When Christianity became the State religion, the basilicas given by Constantine to the Christians became their churches, and the form, with very slight modifications, is still the form in the Romish Church, though the Orthodox Church mostly preferred a different shape.

It is to be remarked that the basilica was not a building for religious purposes amongst the ancients: it was taken by the Romans from the Greeks, by whom it was called *στοὰ βασιλείος*, and was where the king (*βασιλεύς*) administered justice, and where, on the abolition of a king, the *ἄρχων βασιλεύς* did the same.

The Roman basilica was oblong, with a wide nave and aisles, and sometimes with double aisles on either side of a central nave, of which the Julian basilica at Rome may be given as an example. If the basilica was entered at the narrow end, the opposite end, if square, was divided off from the aisles, and the two aisles formed *chalcidica*; the judges sat in the central part, opposite the nave. The Basilica of Maxentius at Rome was entered at the narrow end, and had an apse at the other; the side apses are of more modern date. If the basilica was entered in the middle of the long side, there was generally an apse at the end, as before, and sometimes one at each end, as in the Basilica of Trajan, as shown in Professor Middleton's plan. The columns of the nave were mostly in two heights, with galleries over the aisles.

The nave was used as an exchange, and Vitruvius tells us that in his basilica at Fano, he so arranged it "that the merchants who are in the basilica may not interfere with those who have business before the magistrates." In one of the basilicas found in England there is a transept at the end in front of the apse, thus making the Tau form.

The galleries over the aisles were walled in, so that the occupants could not be seen by those in the area below, and are supposed to have been used by the public to hear the law cases; but these cases could only have been heard in the parts near the tribunal, and one side is said to have been devoted to men and the other to women.

When the basilicas became churches, these galleries were mostly set apart for women, but at Sta. Sophia, Justinian's pew was in the left gallery, probably from its being near the staircase that led to the palace.

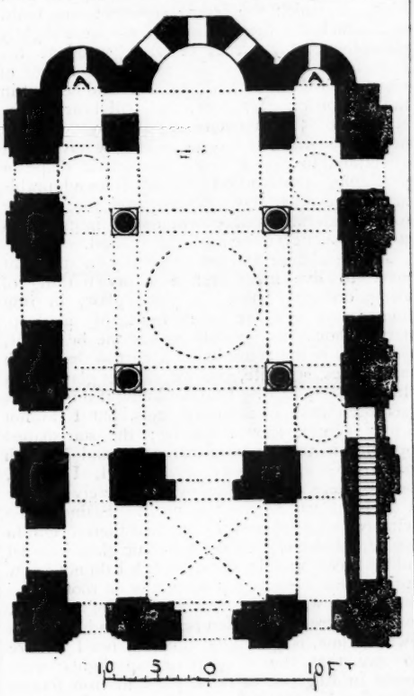
I have mentioned this to show how readily a structure, designed for a totally different end, may be found quite fitted for another purpose.

The luminous cross that Constantine saw as the Tau, or as a Greek or Latin cross, is the form that cathedrals have been given; and even early basilicas had the Tau form, as, for example, St. Demetrius at Salonica. In every country not petrified by custom or religious conservatism, there are changes, sometimes constant sometimes intermittent, in all things, but this is most noticeable in language, as Horace says in his "Ars Poetica":—

> As forests change their foliage year by year,
> Leaves that came first, first fall and disappear;
> So antique words die out, and in their room
> Others spring up, of vigorous growth and bloom.

The same happens in customs that are long continued. We see in the Roman baths, that persisted as large public establishments from Agrippa's days, 27 B.C., to Constantine's, 330 A.D., that many changes were made in their form, and these were probably due to changes in the exercises and routine of bathing. We guess at the uses of the new chambers, but it is clear that the exercises or the bathing in some particulars greatly varied in Constantine's time, for we see two long narrow vaulted chambers that exist in no other baths, of whose use we can only form the vaguest conjecture.

The same thing probably happened in the Christian ritual. At any rate, we see in the churches after a certain date a central lantern, apses added to both aisles, when each was dedicated to a separate saint, and the later additions of chapels round the choir, and eventually at the sides of both aisles of the nave as well. These additions to the structure are too palpable to be overlooked, but doubtless many smaller modifications of ritual caused minor alterations in the structure. The square east ends and apsidal transepts may have followed some ritualistic change. I think, however, it is only lately that we have arrived at the conclusion that one of the grand aims



Plan of St. Bardias, Salonica.

of architecture is to imitate Nature's organisms, and endeavour to make each part of a building absolutely fitted for all its uses, so that the outside may tell us the uses of the building, as the snail-shell does of the snail; though Vitruvius does give a reason why the hottest chamber of a bath should be circular. I think I have roughly given most of the requirements, except the lighting and ventilation, exclusive of æsthetic and emotional considerations, and it may be well to speak of the ventilation first, which, though vaguely known from very early times, has not been definitely known till modern days. The lantern showed its want of ventilation by going out; but people are not generally stifled in unventilated rooms, though their health will be impaired, for a very slight taint of breath will make the air of a room unfit for healthy breathing. A late doctor, in speaking of the ventilation of rooms, said, with some truth, that "the badness of design was mitigated by the badness of the execution," for "every floor-board, skirting, door, and sash, intended to exclude air admitted it." The safety of England, in the shape of ventilation, mainly depends on the open fireplace. I may say, by the way, that innkeepers are allowed to let, as bedrooms, closets that are destitute of open fireplaces or any other proper arrangements for ventilation but those arising from bad workmanship. Each person requires 3,000 cubic feet of air every hour, and if any enclosed space is crammed with people much more is required, especially if some of the occupants are dirty, and wear filthy clothes. It is therefore highly important that rooms should be larger and loftier than they are generally made, besides having a proper ingress for pure air, and a proper egress for the foul, particularly when the occupants stay in them for many hours. I say "proper," because it is of no use leaving two holes and telling the foul air to go out at one, and the fresh air to come in at the other; the air will not obey our verbal orders.

The next point is the lighting, and this should be so arranged that every part of the room be fully lighted,—a thing rarely attended to. A long room is better lit by a large window at the narrow end, and this requires that the room be very lofty if the light is to strike on the far end at the proper height. A cross light is never very agreeable, though it cannot always be dispensed with.

As regards doors and staircases in private buildings, where we have to consider nothing but use, it may be said that they should be big enough to take in a piano and to let out a coffin. When the late William Burges built his house a man said, "Your friend is not fond of music;" and when asked for his reasons he said, "A piano cannot be got into the house through any of the doors or windows."

If we could carry out all these things completely we should, I think, have a perfect architecture, or one at least as perfect as Nature's works. You may say, But what then becomes of all our domes, lanterns, towers, and spires? You would have them, too, if they were necessary. If your chamber were circular, and you wanted the height for air, and the roof incombustible and of brick or masonry, you would have a dome. If you wanted light in the centre of a large building; the means of getting it would probably take the form of a lantern. If you wanted a landmark it would probably become a spire; and if you wanted the sound of bells to be heard at a distance, the shell for these would be a tower of a size sufficient to carry the number of bells wanted, and of a height to let them be heard at the proper distance. In animals, I am inclined to think that all the colouring is protective. Nature has but one scheme,—fighting,—for destroying the worthless, and one for preventing the extinction of multitudes by the slow and painful process of starvation,—slaughter. The struggle for existence is always going on, even in plants. The flat fish that lies on muddy sand is grey; that which lies on sand and shingle is, like the plaice, a brownish grey, spotted with red and yellow, to make them unseen by their enemies. And I have little doubt that the green and silver of the mackerel, so much admired by the New Zealander, is equally protective. The eggs of birds laid in open nests assimilate in colour to their surrounding to protect them from their enemies; the brindling of the beasts of prey doubtless imitates the shadows of the desert sand, and thus enables the beasts of prey, unseen themselves, to see their prey at a distance, and wait until it is within reach; the stripes of the zebra probably make it indistinguishable from the ground it frequents at a distance; while, if we use coloured materials, it is to attract the eye or for beauty. If some colours and patterns on animals are the result of sexual selection, we must leave that for our æsthetic considerations.

As we are very far from being able to rival Nature's creations, we must see how we can attain some small part of the knowledge and skill we want, to imitate her. We must cultivate our faculties, and especially our observation, to see how the different human units behave, and how they combine themselves when in numbers and under various emotions. And we must also see how the architects of past times accommodated this unit, or these multitudes, under somewhat analagous circumstances. The ancients got their knowledge of the powers of materials by experience, but they reasoned on this experience as well. One quality of materials can only be learned by experience and observation, viz., how they weather, but this experience can scarcely be wholly personal, for the length of a man's life is not enough; the other pages of this book of wisdom are written on ancient and antique buildings. We have found out some laws of nature, and we can try what each kind of material will bear in compression, in tension, and in cross-strain; what it weighs, how much water it will absorb, and what not; reason on these facts, and use them as they answer our purpose: this is what the engineers do, and we see what constructive wonders they have accomplished with iron! Any mechanical trick in architecture will certainly arrest attention, though I think it is a mean expedient; yet we know the Mediæval architects were very fond of this trick; they were, however, great jokers. They had found out the tensile strength of stone, and availed themselves of the

knowledge to support vaults on pendents, as you may see in Henry VII.'s Chapel at Westminster, at King's College, Cambridge, at St. Ouen, Rouen, and elsewhere.

In the Courts of Justice at Barcelona, there is a quadrangular court, arcaded on the first floor. At the angle by the staircase the two arches at right angles to one another are carried, or seem to be carried, by a pendent; this is not all, for the passages at the back of the arcades are vaulted, so that this pendent carries the diagonal rib as well.

In rude times the materials at hand must always have greatly influenced the buildings. Early nations with little wealth, small means of transport, and generally surrounded by hostile tribes, must have been forced to make their buildings of the materials at hand; thus Strabo tells us that in Assyria "all the houses are vaulted on account of the want of timber;" and in speaking of the Hanging Gardens of Babylon, he says—"Their pillars, their vaults, and their terraces, are constructed of baked bricks and asphalte."

The Athenians were fortunate enough to have mountains of marble at hand; the Romans, from having no good building stone nearer than Tivoli, but excellent sand, used brick and rubble. Viollet-le-Duc recommends the study of Gothic to the French architects, for teaching them the ingenious practices of the Middle Ages and for sharpening their wits; and pays them the compliment of saying that they could raise fine buildings in paper if they were confined to that material.

All materials are good if used in an appropriate manner; but in London, where all the materials that have ever been used for building are to be found or got, we have mainly to choose those which answer our purpose and our pockets the best.

A caution may be given here, that all materials that can be cast or moulded may be used for the purpose of imitating ornamental work originally executed in a different material, and this sort of mean imitation has been used in papier-maché, compo, cast-iron, and terra-cotta. We have used little cast-iron to imitate stone work, but American architects say it has been largely used in America.

I do not recollect even a stone spire, nor a stone front, imitated in cast-iron in England; though we have thousands of acres of imitation carved work in papier-maché, compo, and plaster; but the terra-cotta leprosy is spreading over London and the provincial towns. Terra-cotta for ornamental panels recommends itself strongly to us *à priori:* we fancy we shall get the very touch of the artist, only shrunk by baking, but, in fact, it is all cast or squeezed work; but the objection is to its purely architectural use. Little curly bits put together imitate, very badly, I admit, stone mullions and transoms, but they have to do duty for them, and we ask how they are held up and together. The brick or concrete backing that forms the real walls of the building are faced with a thin veneer of terra-cotta that looks like big blocks of stone, and large buildings have a skeleton of iron filled in with concrete, rubble, or brick; yet all the walls look as if they were built of stone; it is less truthful than compo, and no line or moulding is so straight, and it may turn out to be even less durable. It is exactly the same as a cast-iron front in imitation of stone, only instead of being of molten metal, it is of baked mud. It would not be so delusive if it were enamelled, as we should then scarcely expect it to be solid.

The only other material that needs mentioning is iron. Mr. Ruskin objects to its use because it was unknown to the ancient Jews, and is not mentioned as a building material in the Bible; still, in spite of this religious objection, it is being used more and more daily, only as yet it is barely avowed. Like all materials it has its drawbacks: it rusts, it rapidly absorbs heat, and its contraction and expansion are great and irresistible; if heated or cooled it pushes out or draws in the masonry, or is itself torn. Like every other material, it must be shaped, moulded, and ornamented in accordance with its native powers and capacity. We cannot even imagine that the Mediæval architects would not have obtained astounding effects if they had had to their hand a material that was twenty times as strong as good free stone, and could be moulded into any form that was chosen, even if that form was unadapted to its nature; nor that they would not have been able to mould or ornament it to their taste.

We cannot, I think, be said to have learnt our business if we can do nothing with it, and I think much the same may be said of concrete and cement. We have not done much with enamelled brick, if we compare our achievements with the magnificent Persian friezes from Susa; and next to nothing with solid glass.

The Romans were a constructive race, and they never neglected any raw material, however unpromising, if it would serve their turn at a pinch; and, thanks to M. Choisy, we have learnt that economy was one of their ruling passions. Stone chips or brick-bats, fragments of lava or rough stones, flints or pebbles, were almost sure to be met with where they built, and they built wherever their Empire extended; but bricks were always dear, even if they were at an easy distance from the works: the clay pits had to be found and dug, the clay to be tempered, the bricks to be moulded, to be dried, and to be baked in kilns with firewood, and then to be carried to the place where they were wanted, so they used as few of them as possible, and to make them go far, used them as triangles with the hypotenuse for the face, and made the cores of their walls of rubble, or, if you prefer the word concrete, of Roman concrete; for I think there is no doubt that the solid part of the concrete was laid by hand. I cannot help believing that the brick face kept up the squashy rubble, or else why go to the expense of the facing? But this plan by no means exhausted their ingenuity. In Tunisia they wanted to build an aqueduct varying from 70 ft. to 120 ft. high, but had, at hand, in one of the valleys, nothing but dry earth, so they mixed this with lime and made blocks of it, 3 ft. 8 in. high, of which the whole aqueduct was built, arches and all: these tender blocks were slightly strengthened by pieces of olive wood at the bottoms. We can make common concrete of clean washed ballast and good Portland cement in the proportion of 7 to 1, that will bear on the cube foot 85 tons before it cracks, yet we have used it but little, and as far as I know have never attempted to give it any characteristic shape or moulding. Portland cement, too, is an admirable material as a protection against wet for poor or rough materials, but except as an imitation of stone it has never been artistically used.

A greenhouse is not generally a pleasant place to live in, therefore I say nothing of using ordinary sheet or plate glass, in iron frames, though for the front of a deep, narrow house it probably makes the best front, especially if the house be in a narrow lane with tall houses opposite, but we can get glass a foot thick if we want it. I do not know if thick glass has been used in masonry roofs, but I do not know why it should not be; the star-shaped openings in the domes of Saracenic and Moorish baths are very pretty, and could, I think, be used here in many buildings, if merely to give a pleasant variety to the vault. Stained-glass windows are supposed to have had their origin in Rome, when clear cubes of mosaic glass were let into pierced marble slabs, though I do not know if they were even used horizontally on roofs.

To learn who was the real inventor of anything, even though the invention has been made in one's own lifetime, is generally difficult; but I venture to say that the first pavement lights were made in England of thick glass in iron frames when the duty was taken off glass; and this plain glass was superseded by lenses, but very little use, as far as I know, has been made of it here, while in Paris the whole of the floors, and consequently ceilings of all the stories have been made of it in the Crédit Lyonnais, and this does not say much for our wit; and there is ten times more enamelled pottery used in France than here, though I believe we were the first re-discoverers of this forgotten art. To dwell first on its sanitary advantages: from being glazed it affords a worse hold for dust and soot than rougher materials, and what dust and soot does cling to it almost calls out to be washed off, from its obliterating the colour and pattern. The capability of enamelled brick or terra-cotta to be washed without injury makes it compare favourably with paint after the first outlay, and it would not only give brightness, but colour, to our too dingy streets, and help to raise our spirits during the prevalence of the dull and misty weather which contribute so large a share of days to the year; but the delight of colour would be a pure gain, for it is in this that all western towns are so sadly deficient. It seems curious that it should have been so little applied in our grimy manufacturing towns, where cleanliness, brightness, and cheerfulness are so much wanted. Where we do find it largely used is in dry sunny climates, where there is practically no soot—in Persia, in Cairo, and in China.

The advertising shopkeeper would, too, find it an admirable field for puffing his wares; and if his architect made these advertising panels beautiful, we should, at least be spared from seeing the whole architecture of London ruined or hidden by boards or paper "posters."

I think every unprejudiced person would say, when he understood the subject, that every architect ought to be a master of statics. But how few are! How it would thin the ranks of the students if the knowledge of so arid a science were to be a requisite, instead of an instinctive taste and a slight aptitude for sketching. Yet all that an architect can do is by directing building, and what can he direct to be done? The height, width, thickness, and shape of walls and vaults, and how these are to be shaped, moulded, or pierced.

Anthemius of Tralles, who built the great Sta. Sophia, must have known practically a good deal about statics to have ventured on so bold an experiment; and we should have admired him still more if his knowledge had been more complete; but nowadays, to know even a little of the very foundation of the art is supposed to unfit a man for being an architect.

It is most curious that when English architects are deploring the waste of time involved in uselessly learning construction, the French architects are deploring the opposite tendency. M. Corroyer, the architect who wrote the celebrated book on Romanesque, says in his last publication:—

> "In England, in Belgium, in Holland, in Switzerland, and in Germany, the architects are at the same time engineers, and for them art is closely bound up with science. Thus, certain of their works owe to this alliance a particular character which ought to inspire us with very serious reflections. . . . . We shall be obliged at the first glance to recognise that we are actually being influenced by this practice, instead of impressing our practice on others as we formerly did. . . . . However, we must not allow the auxiliary of yesterday to become the master of to-morrow, nor the architect to abandon his high functions, so noble and so beautiful of yore, to become a simple, or even a skilful decorator." *(L'Architecture Gothique by Corroyer: L' Architecture Militaire. Cap I.)*

Sir Christopher Wren was not altogether a bad architect, and he knew statics theoretically as well as practically. Genius, with practical knowledge and daring, may do much, but it is like being in a wood without map, compass, or a knowledge of the paths: you go a long way round before you get out. All and more than all that the practical man can pick up in his life time, may be learnt theoretically in a few years.

It is, however, only quite lately, since Renaissance days, that the proper education for architects was ever thought of. Pericles' principle in the education of his son was followed, and we tried to become statesmen by riding on two horses. Why architecture stopped was very simple: it fell into the hands of those who did not even know what it was.

The Renaissance architects were scholars, antiquaries, goldsmiths, sculptors, and painters. If you could draw the human figure and chase a gold cup, you had, in their opinion, all that education could give to an artist, and this belief generally persists even to the present day. The Architectural Association is the only teaching body in London, that I have heard of, that attempts to impart to architectural students a knowledge of statics, and of the strength and qualities of materials. We do not know what was the training in the architectural schools that Constantine started, but we know what architects could do in Justinian's time. In the same century St. Benedict started a school of architecture in France, and this teaching was carried down in the various abbeys till the thirteenth century, when the architects formed themselves into lay guilds. We see to what a point of perfection the teaching had raised the architects. This theoretical teaching was continued through centuries, and was supplemented by practical knowledge acquired on buildings; though something was due to the current passion for geometry. The æsthetic form which Mediæval work took may or may not appeal to our taste, but the vast and lofty works erected in Mediæval times, under enormous difficulties and with slender means, must excite our wonder and admiration; there is some truth in what Ware says, for with him architecture meant construction:—"In the time of Pericles, though sculpture might be mature, architecture was in swaddling clothes."

In a capital like London, anything may be learnt that the learner likes and is able to learn, more especially now that books are so plentiful and so cheap, and there are so many free libraries; but it should be remembered that if the time devoted to learning is squandered, through folly, ignorance, or misdirection, the chances of ever getting again the education you have missed are small. Most youths during the years devoted to learning are fed, housed, clothed, warmed, and supplied with relaxation and amusement at other people's expense, but directly they start in life they have to labour for these things, and few have the health and strength to learn what is wanted

in their spare time, even if they have the energy and perseverance.

In my pupil days money was much scarcer than it is now; books were very rare and very dear, and there was hardly a free library. The architectural education of an office consisted of learning how to rub up Indian ink, to strain paper, to draw out the six Roman Orders, and perhaps the three Greek ones, and to sketch a piece of floral ornament. The Classic column and its entablature were looked on as the *ne plus ultra* of architecture; the remaining days of pupilage were employed in tracing or inking-in drawings, copying specifications, squaring dimensions, taking plans, measuring up artificers' work, and drawing out the sketches of the master for practical but unarchitectural work. Some architects supplemented this by allowing their pupils to draw out some modern masterpiece, and to design a public building. This had to be large, and mostly with circular, oval, or octagonal rooms, with plenty of columns and pilasters, but with no definite object; it might be a palace, a house of parliament, a post office, or a bank, for to what purpose it was to be put was no part of the designer's programme.

The passionate study of Gothic did not do much to destroy the Classic fetish, it merely set up another; and, though the study of Gothic was valuable, its immediate effect was to engender a bitter war of words in which "pagan," "papist," and "barbarian" were freely bandied about. Both fetishes were upset by the Dutch Renaissance, so that it was like the triangular duel:—

> "As when a barber and a collier fight,
> The barber beats the luckless collier white;
> The angry collier heaves his pond'rous sack,
> And big with choler beats the barber black.
> Up comes the brick-dust man, with grime o'erspread,
> And beats the barber and the collier red."

ROYAL INSTITUTE OF BRITISH ARCHITECTS:

LONDON STREET IMPROVEMENTS.

THE seventh ordinary general meeting of this Institute was held at No. 9, Conduit-street, on Monday evening last, the President, Mr. J. Macvicar Anderson, in the chair.

Mr. Arthur Cawston, Associate, read a paper on

The Advantages of Adopting a General Scheme in Making Improvements to the London Streets.

The author commenced by saying that some time in March last he ventured to represent to the Chairman of the Art Committee of this Institute that the architectural improvement of London was a suitable subject for that Committee to consider. The interest that Mr. Waterhouse at once displayed resulted in the Art Committee making a serious attempt at finding a practical method for dealing with the subject. As a result of their deliberations, the Committee unanimously passed on November 17 last the following resolutions:—

"That this Committee is of opinion that the only thoroughly satisfactory method of improving the plan of London is by the preparation and adoption by the Municipal Authority of London of a comprehensive scheme.

That such scheme when settled and authorised should be gradually carried out by dealing with the more urgent improvements from time to time, as the London County Council may deem advisable.

That the Council of the Institute do approach the London County Council upon the subject, with a view to offering assistance in the preparation of a ground plan for the improvement of London.

That the Committee are of opinion that Mr. Cawston's paper, referred to in the resolution of October 6, will best introduce the importance of the subject to the Institute; but that upon so vast and intricate a subject the individual members of the Committee are not prepared to assume responsibility for all the opinions and suggestions expressed therein."

The paper referred to in the last of these resolutions was the paper now brought before the meeting. When they as architects remarked the convenience and the spaciousness of well-ordered Continental towns, they could not resist a feeling of admiration for their grandeur, and a just feeling of pride in their foreign professional brethren whose ability and labour had produced such splendid results. But if their *confrères* abroad were entitled to praise for the splendid works they had achieved, could we here in London claim any such praise for what *we* had done towards the improvement of our capital?

When last year the Government tardily attempted to remedy the block in the law business of the country, they referred the question to a council of judges, who, as heads of the legal profession, were evidently considered responsible for the defects which caused the block. In the same way with regard to architecture, we could not get away from the fact that any impartial observer must consider that architects, more than any other body of Londoners, were responsible for the inadequate and inartistic streets of our capital. Of course they who were in the secret knew (to their cost) that the real reason why London had lagged behind in the march of improvement was to be found in the fact that we had had no real municipal government, and naturally no municipal enthusiasm. Unfortunately, however, that was not universally appreciated, and so architects continued to suffer reproach for the absence of convenience and dignity in our streets.

However, we had now a popularly elected governing body. All excuses for procrastination therefore were gone, and London ought now to become what her inhabitants desired, and what her architects were able to make her.

Of recent contributions to the Institute on foreign cities which particularly referred to the subject before the meeting he need hardly remind them of that from their members, Messrs. Farrow and Blashill, who in 1889 gave an interesting account of those splendid extensions which had already taken place in Vienna; or that, in the same year, Mr. Francis Hooper, as holder of the Godwin Bursary, studied in Paris, and delivered before the Institute a most valuable account of Building Control and Administration in France. In his paper were enumerated the series of laws under which our industrious and thrifty neighbours had nearly completed the rebuilding and transformation of their capital. A vast transformation indeed, which had perhaps never been more powerfully described than by Mr. Albert Shaw, that most competent critic of municipal institutions, who wrote as follows:—

"In the work of transforming the labyrinthine tangle of narrow, dark, and foul Mediæval alleys into broad modern thoroughfares, and of providing those appointments and conveniences that distinguish the well-ordered city of our day from the old-time cities, which had grown up formless and organless, by centuries of accretion, in this brilliant nineteenth century task of reconstructing cities in their physical characters, dealing with them as organic entities, and endeavouring to give such form to the visible body as will best accommodate the expanding life within, Paris has been the unrivalled leader. Berlin and Vienna have accomplished magnificent results in city-making, and great British towns,—Glasgow, Birmingham, Manchester, and others,—have in a less ambitious way wrought no less useful reforms; but Paris was the pioneer. French public authorities, architects, and engineers were the first to conceive effectually the ideas of symmetry and spaciousness, of order and convenience, of wholesomeness and cleanliness, in urban arrangements."

The grandeur and masterful thoroughness of the work proved that Paris as it existed at present was the modern model city London was probably destined to copy, as the increasing density of population made it necessary to pile up many more human beings on a square mile, without impeding a constantly increasing circulation.

For that reason, and because of the great strides in sanitary knowledge during recent years, it was essential that our metropolis should, as far as possible, be improved and adapted to the requirements of to-day. The principal reasons for such improvements might be briefly indicated under the five following heads: (1) The benefits to health, (2) to traffic, (3) to the labouring classes, (4) to the metropolis generally, and (5) to the nation.

They all knew what had already been done in reducing London's death-rate, but that rate in some of those districts where the population was most dense, such as Bethnal Green, still remained at 40·0 per thousand. It was just in those districts that one of the greatest dangers to the health of London lay. They were the spots on which epidemic diseases fastened, and until they were transformed, progress in lessening the general death-rate would continue to be arrested. Not only so, but London, which was once in the van of sanitary progress, had lost her place, and until the remedy be found, would fall further and further behind cities to which she formerly showed the way. The following figures were taken from the annual summaries of deaths issued by the Registrar-General since 1874, from which date only the death-rates of foreign cities have been included in the summaries:—

Death-rate in twelve leading European Cities in 1874 and 1890–1.

Cities.	1874.	1890-1.*	Decrease of death-rate.
Berlin	32·9 per 1,000.	20·9 per 1,000.	12·0 per 1,000.
Liverpool	32·0 ,,	23·6 ,,	8·4 ,,
Birmingham	26·8 ,,	19·7 ,,	7·1 ,,
Hague	26·5 ,,	19·5 ,,	7·0 ,,
Glasgow	31·1 ,,	25·3 ,,	5·8 ,,
Turin	26·7 ,,	22·8 ,,	3·9 ,,
Rome	27·5 ,,	23·6 ,,	3·9 ,,
Brussels	23·9 ,,	21·5 ,,	2·4 ,,
London	22·5 ,,	20·3 ,,	2·2 ,,
Paris	22·4 ,,	21·6 ,,	0·8 ,,
Vienna	24·6 ,,	24·6 ,,	Nil.
			Increase.
Dublin	26·0 ,,	26·5 ,,	0·5 per 1,000.

* NOTE.—During the years 1890-1 influenza was prevalent in parts of Europe, and affected the death-rate materially. For this reason where the rate seriously differed in any city during these two years, the lower rate was quoted as being closer to the normal rate.

These figures clearly showed the improvement that had taken place in many large cities, and they also showed that no material alteration had taken place in the health of London and Paris during the same period. The reason of this was, he thought, to be found in the fact that radical changes were being made in those cities which showed marked improvement, while in London and Paris little change took place during that period.

For instance, between 1875 and 1885, Birmingham transformed about 80 acres in the centre of the town from squalid slums into fine thoroughfares. Mr. Chamberlain, in his evidence before the Royal Commission on the Housing of the Working Class, stated,

"The effect on the death-rate has been very remarkable indeed. The eight most insanitary streets in the area before the scheme averaged, for the three years before the proposals were in operation, 53·2 per thousand; since then, in the last three years, the same streets have averaged 21·3 per thousand, and the scheme in part, with the other causes to which I have referred, throughout the borough of Birmingham, have led to a general reduction of the death-rate throughout the borough from 26 in the thousand for the three years 1873, 1874 and 1875, to 20 in the thousand for the three years 1880, 1881 and 1882."

In Glasgow, the City Chamberlain stated that the great municipal work of breaking up the dense fœtid closes in the old central districts of the city, together with improvement in sanitary administration, had resulted in the annual saving of the lives of 1,271 inhabitants. This great municipal work was also completed during the period referred to. Similar sanitary and street improvements were being vigorously carried out during the same period in Berlin, Liverpool, and the Hague.

No doubt these great strides of improvement were taken in following the example of London and Paris. London had, before this period, by the construction of her great sewerage works and other sanitary improvements, reduced her death-rate materially, and Paris, by abolishing her slums, and transforming herself into a city of wide and beautiful streets, had also reduced hers. But during the later period above referred to, both London and Paris more or less rested on their onward march, for no one could believe that the London death-rate of 20·3, or the Paris death-rate of 21·6, was the ultimate goal of sanitary reform. Many of them, indeed, believed in the possibility of reducing those figures to one-half. That that was no dream was shown by the death-rate of Hampstead, which was 14·7, and by the striking experience of the Artisans' Dwellings Company, which was able to boast of a death-rate in its tenement blocks of 12·85.

In attempting to carry out extensive alterations in conservative London, many great difficulties and expenses would have to be faced, most of which would not have existed if in the past there had been efficient municipal control. The want of a general plan showing future street alterations authoritatively settled had also undoubtedly been the reason why many streets lately formed were not for the general convenience, had not been financially successful, and had neither created enthusiasm amongst the public nor brought credit to the authorities.

The author next proceeded to examine in detail, and under the following heads, the reasons for having a comprehensive plan, and as complete a comprehensive plan as possible:—

1. For discovering the *causes* of our present inconveniences.
2. For producing the *best* improvements that can be produced.
3. For forwarding them as *rapidly* as possible.
4. For making them as *economically* as possible.
5. For *æsthetic* reasons.

The Importance of a General Plan for Discovering the Causes of Our Present Inconveniences. — Immediately a general plan of London was examined by anyone anxious to solve the many problems of our present inconvenient streets, to discover where slums were mostly to be found, and the reasons that had prevented improvement, he must be first struck by the fact that many slums existed in the very centre of our capital on sites which, in a well-arranged city, would be the most valuable. The cause was soon apparent, and, as usual, the impediment to progress was the English law. Look at the shape and extent of the "Devil's own" estates, which extended a distance of about three-quarters of a mile, from Theobald's-road on the north to the Thamas embankment on the south, and which presented a barrier against any attempt at opening up the most crowded districts of central London, of admitting to them more light and air, or of allowing any better means of communication between the City and the West-end. Wherever barriers to free circulation existed, whether in a

river, in the human frame, or in a city, there would be formed an aggregation of scum, of disease, or of slums. Now such a want of free circulation existed in central London on both sides of the Inns of Court, and hence the unpardonable squalor peculiar to the slums in the central square mile of our capital. The first urgent need for improvement, therefore, was the opening up of these districts by broad thoroughfares, which must of course pierce the sanctuaries of the law.

Other impediments to free circulation would, unfortunately, be found. South of the Thames, railway viaducts and embankments divided the metropolis into sections, and severed contiguous districts, when the trouble, danger, and nuisance thus caused would have been entirely avoided by making the lines in cuttings or tunnels, as on the north side of the river. Superb public parks and gardens were so enclosed and so difficult of access as to form most serious impediments to street improvement, and the full benefit of their presence was denied us, whilst their surrounding streets were filled to overflowing. A wide tidal river hemmed in, and was hemmed in, by stifling purlieus that had become crowded and neglected for want of opening up by wide streets and additional bridges. These were but a few of the difficulties that must be removed if London was to be made convenient and healthy. If it was also to be made beautiful, other difficulties had to be overcome. We found many public and other important buildings hidden away in tangled and crowded streets, so as to be almost unapproachable, and entirely forgotten. Whilst many hills in our home counties offered sites which were in every way suitable, we found here in central London asylums for lunatics, schools for the blind, homes for foundlings, occupying acres of unsuitable sites in crowded districts, impeding surrounding progress, and depriving their hard-working neighbours of healthy homes.

The Importance of a General Plan for Producing the Best Improvements that can be Produced.—Probably the best complete scheme of London improvements should embody—(*a*) The complete utilisation of every district of London's enormous area for its most valuable purpose. (*b*) The creation of continuous arteries, sufficiently wide for the future as well as for to-day, and judicially placed so as to connect the most important centres of business and habitation and the railway termini. As to the first (*a*), that consideration had up to the present time been entirely lost sight of whenever improvements had been considered, consequently, the re-housing of the displaced working population, a question inseparable from the improvement schemes in London, had always been a most serious difficulty. As it seemed most probable, for many reasons, that improvements would be carried out in the slums before elsewhere, the question still remained of the first importance. It was no doubt necessary for the working classes to live within a reasonable distance of their work, but surely it was not consistent with the general welfare to give up the very central square mile of London to such purpose, especially as more comfortable and healthy dwellings could naturally be provided where land is so much cheaper, as in parts of Southwark, Lambeth, Clerkenwell, and Marylebone. If a map of London were studied, acres upon acres of land which could be made available for workmen's dwellings, and which was most likely always to remain the most valuable and suitable for that particular purpose, was at once discovered within a mile of the centre of the metropolis. Such sites were occupied by the Foundling Hospital, the Military School at Chelsea, and many similar institutions, Bethlehem and St. Luke's Lunatic Asylums, many gas-works and water filtering beds. Would it not be well to remove these present occupants into the suburbs or the country, and clear the sites for labourers' dwellings? Some of them might regret the disturbance of old hospitals, but a larger majority of them regretted more sincerely what was apparently the only alternative, namely, the removal of workmen to the suburbs, and the consequent loss of time and money in conveying them to and from their work. He had calculated that fifteen sites, which he proposed should be gradually devoted to this purpose, contained an area of 144 acres. After deducting one-fifth of this area for additional broad roadways, and, assuming that the same density per acre would be as healthy on those sites as on the site of Peabody dwellings and playgrounds in Drury-lane, the extra number that could be accommodated within one mile of the centre of the metropolis was found to be 127,000 men, women, and children. As to the second point (*b*), the creation of continuous arteries sufficiently wide for the future as well as for to-day, and judiciously placed, so as to connect the most important centres of business and habitation, and the railway termini, immediately a comprehensive plan was studied, the small number of our main streets, and the shortness of our other streets, was at once manifest. As Mr. Albert Shaw remarked, "London, like all other old cities, is a vast, tangled network of streets that for the most part begin nowhere and end nowhere." Without doubt, the longer and the more uniform streets were made the more valuable they became for many reasons. But length and uniformity could only be obtained by first planning streets to a small scale on a complete plan of the whole county. In many cases, too, quite insignificant clearances at various points were only required in order to render many of our side streets suitable for relieving the present overcrowded main streets to a very considerable extent. Every surveyor knew what had been the cause of these small obstructions, and how they were still being created by the absurdities and difficulties that existed in connexion with laying out building estates in London, especially in the suburbs. For instance, no matter how irregular might be the shape of an estate which was to be developed, the owner was allowed, in order to follow the contour of his boundaries, and to cover with houses every corner of his property, to make his roads tortuous as snakes, so long as they led from one existing road to another. He was not, however, allowed to form any road which stopped at his own fence, no matter how essential such road might be for the development of the adjoining properties. Thus more and more unhealthy and badly ventilated districts were being daily created, whereas if a settled plan were adopted, the development of each property would be a matter of general importance, and while adding to the convenience of the district, the property itself would be benefited.

The Importance of a General Plan for Forwarding Improvements as Speedily as Possible.—If a comprehensive plan for improvement were authoritatively adopted in London, no single building in the whole county could be rebuilt without reference to the revised lines of frontage as laid down on that plan, or without becoming an integrant part of the grand city that it would be the ultimate object of the plan to produce. That such a system would be of paramount importance for speedily effecting improvements would be shown by the following comparisons. The annual average number of notices for new buildings and re-buildings issued to District Surveyors during the last three years had been 21,932. As nearly all our streets admittedly wanted improving, as many central districts admittedly wanted entirely re-modelling, and as all districts newly created in the suburbs were, at present, created without any reference whatever to the general convenience, we might fairly assume that one-fourth of these 21,932 annual notices referred to re-buildings, which would each give an opportunity of advancing, under a comprehenstve plan, the complete scheme for the improvement of London. On the other hand, the approximate total number of houses that would be removed by the Council Broadway improvement is 1,250, and what with legal and parliamentary delays, that improvement might take about five years to complete, from the time it was first made public. That gave an *annual* average of 250 houses removed by one costly improvement, compared to 5,500 opportunities for improvement which would *annually* and automatically arise immediately a comprehensive plan were adopted. Again, it must be remembered that in the one case, every opportunity would come without legal expenses or delay connected with compensation for disturbances; whereas, in the other case, legal expenses and delays, and expensive compensations for disturbance, occurred in the case of each property taken. If, moreover, a comprehensive scheme were delayed, not only would 5,500 automatic and cheap opportunities for improving London be lost every year, but the very rebuilding on these sites would form the same number of impediments to be removed, each ten times as costly as the opportunities that were lost. It was true that Ludgate-hill has taken about thirty years to widen, and that the case of that improvement was used as an argument against the so-called "automatic" principle. The case of Ludgate-hill, however, was an abnormal one. The greater cost of the properties more recently acquired there had been due to the fact that Ludgate-hill had been allowed to remain, practically, the only main line of communication through that part of London. All the enormously increased traffic was forced through that artery, with the result that its frontage sites had increased in value to an unnatural extent.

The Importance of a General Plan for Making Improvements as Cheaply as Possible.—Not only did the foregoing arguments prove the greater speed at which improvements could be made under a comprehensive scheme, but they also proved how a great saving in cost could be effected. There were many other economic reasons for a comprehensive scheme. For instance, when any isolated improvement was put in hand, it was necessary to calculate the approximate cost of the whole work, to borrow money to pay for it, to agree to complete it in a given time, and to refund, within a certain number of years, all that had been borrowed. In that way the cost of improvements was greatly augmented, for it not only included the cost of the actual work, but a large annual amount for sinking-fund, interest, and the accompanying expenses. If a comprehensive scheme was ever adopted, that running into debt would be totally unnecessary, for the Council would then be enabled to put just so much of the scheme in hand as the funds available for that purpose from the year's income would permit. Again, one of the great impediments to street improvements, up to the present time, had been the terrible cost of acquiring properties, and it had been found again and again that whenever an improvement had been decided upon, speculators had bought up the property, had had drawings prepared for new buildings, had improved existing buildings, and put all possible legal impediments in the way for the sake of making the authorities pay largely augmented compensations. The economic importance of adopting a comprehensive scheme was here again apparent, for it would be impossible for any individual or even any syndicate to purchase all the land which would be affected by the whole scheme, consequently the Council would have so much choice that they could purchase small portions here and there whenever the owners wanted to sell or were willing to sell at a reasonable price. Mr. Chamberlain's experience on that point during the municipal improvements in Birmingham, as stated by him in his evidence before the Royal Commission on the Housing of the Working Classes, conclusively corroborated the correctness of that view. It was also absolutely essential that a settled scheme should be adopted for another reason. As each new street was laid out, quadrants and places should be constructed with junctions left exactly where future new streets would eventually join them. A striking illustration of the want of that foresight might be found in the case of the English Opera House recently erected in Cambridge-circus and Shaftesbury-avenue. That building had been placed exactly where a new street, which might become as important as Oxford-street or the Strand, should cross that circus.

As already stated, large and most valuable sites were still occupied with slums of the poorest description. Under a settled scheme the whole of these sites would gradually be put to their proper uses, and the recoupment that would then arise from the sale of surplus lands would go far towards the economic success of the improvement. A striking example of increased value had occurred at Chelsea, on the estate belonging to Earl Cadogan, who was advised on high authority to let a piece of ground at a ground-rent of 85*l.* per annum. Because the whole neighbourhood had been developed in a statesmanlike manner, land had increased so much in value that the ground-rent of the same piece of ground had been, within five years, improved by the leaseholder to 900*l.* a year. Not only so, but certain adjoining land, which was held in trust for the public, had increased in value by the action of the noble neighbour to at least 300 per cent. If a comprehensive plan of improvements were adopted, all the undeveloped land in the county would, as it became ripe for development, also be automatically, and thus economically, opened up in accordance with the scheme. Both the community and the landowner would benefit by that, the former by having its streets made in the most convenient position from a public point of view, and the latter by being guaranteed a greater number of important thoroughfares across his property.

The Importance of a General Plan for Æsthetic Reasons.—"The works of those," said Sir Joshua Reynolds, "which have stood the test of ages, have a claim to that respect and veneration to which no modern can pretend." That spirit of veneration, together with the knowledge that whatever improvements now made would be carried out in a time when ancient architectural monuments would be as jealously guarded as ancient sculptures and paintings, was a consoling

thought, when we remembered the delays that had occurred in our street improvements. Was it possible that any scheme *could* produce sufficient improvements to an ever-increasing metropolis like London, without of necessity doing away with well-known landmarks, which, be they ever so faulty, had naturally become endeared by familiarity? Undoubtedly. By studying a comprehensive scheme it was soon discovered that sufficient lengthy arteries connecting the most important centres of business and habitation could be provided in such a way as would not only obviate the interference with our present main streets, or with architectural heirlooms and landmarks. For that reason alone such a scheme should commend itself to many, but it would also succeed in raising municipal enthusiasm. What had been up to now the despair of all reformers of London municipal life? Had it not been the huge size of the city and the supposed impossibility of uniting for one common object the inhabitants of its distant parts? Could anything be more calculated to raise the pride and enthusiasm of all Londoners, and weld them together for one common object than a really great scheme of improvement?

In conclusion, the author pointed out, by the aid of two maps, his proposals for the improvement of London, which were based on six general principles, having for their object—1. To open up portions of our town parks and some other open spaces; 2. To open out the most crowded districts, and admit more light and air; 3. To create many more great arteries connecting the most important centres of business and habitation; 4. To provide additional bridges over the Thames; 5. To facilitate the approaches to the several railway termini; and 6. To open out as much as possible our public and ancient buildings, and to provide sites for new.

The President, in inviting discussion, said that Mr. Cawston had certainly taken a very comprehensive view of the subject, which was one of great importance to Londoners. The Institute was favoured on that occasion with the presence of several members of the London County Council, amongst whom was Mr. Frederic Harrison, the Chairman of the Improvements Committee of the Council. Perhaps Mr. Harrison would kindly favour the meeting with his views on the subject.

Mr. Frederic Harrison said he came there as a learner rather than as a teacher. While he thanked the Institute for allowing him and some of his colleages of the Council to be present that evening, he did not feel that he was in a position to enter upon any discussion of the very important points touched upon in the paper. He wished to say, however, that it must not be supposed that there was any foundation for the idea that the London improvements which had been carried out during recent years had proceeded upon no settled plan. It was quite true that no settled plan had been submitted to the public, for the very excellent reason that if it were to be published it would lead to speculation in the property affected, and would greatly add to the cost of carrying out the proposed improvements. As it might become his duty in his capacity of Chairman of the Improvements Committee of the Council to give evidence on this question before Parliamentary committees during the present session, he must beg to be excused from entering into the merits of the various proposals referred to by the author of the paper. In conclusion, Mr. Harrison referred to the limited powers of the London County Council, which rendered it necessary for that body to go to Parliament to obtain an Act before it could appropriate a single penny for the carrying out of a public improvement, and he also touched upon the financial aspect of the proposals made by Mr. Cawston, which would require, perhaps, an outlay of from 100,000,000*l.* to 150,000,000*l.*, and he feared that there was no chance of such an outlay being incurred just yet awhile for street improvements in London.

Dr. G. B. Longstaff, Chairman of the Building Act Committee of the London County Council, said that while he agreed with his colleague, Mr. Frederic Harrison, as to the financial aspect of the questions dealt with in Mr. Cawston's paper, there was no doubt something to be said in favour of the idea that we should look ahead and carry out new works in contemplation of their extension in the future on a systematic plan. The Committee with which he was officially connected had lately spent a great deal of time, as had also the Council of that Institute, in the framing of what they conceived to be an ideal building law for the Metropolis. It had occurred to his committee, though their proposals had not yet been made public, that something might be done towards a scheme which would be really automatic. The great difficulty in London at the present time was that those provisions of the Metropolis Local Management Acts which regulated the setting-back of frontages did not apply to all sites. He thought that that was one of the greatest evils with which we had to contend in London, and he hoped that it might be possible hereafter to legislate for the setting-back of frontages on old sites as well as on new ones. Dr. Longstaff went on to discuss the true signification of the figures as to death-rates of large towns quoted by the author of the paper, and said he did not think that there was any possibility of further diminution of the death-rate in London.

Mr. Ralph Nevill strongly criticised Mr. Cawston's paper, especially deprecating his proposals to interfere with the gardens of the Inns of Court.

Mr. James Neale also criticised the paper, and said that Mr. Cawston in no way represented the views of the Art Committee or of the members of the Institute as a body. He characterised Mr. Cawston's proposals as most impracticable.

Mr. Alfred Waterhouse, R.A., in proposing a vote of thanks to Mr. Cawston, said he was glad to hear that the County Council was carrying out London improvements on a settled, well-defined scheme. That would be news to most of them.

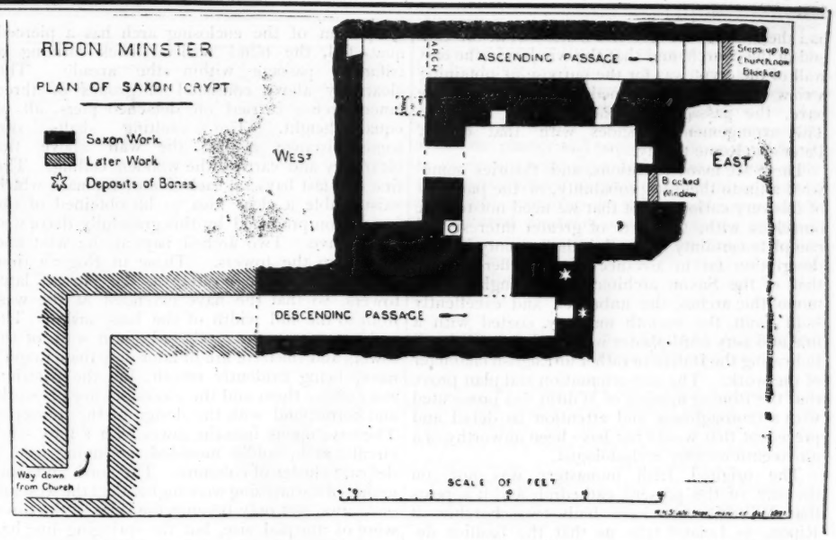
Mr. H. H. Bridgman, in seconding the vote of thanks, said that the piecemeal carrying out of street improvements had not been found to be economical in the City. Ludgate Hill was a case in point.

Mr. Francis Hooper, in supporting the vote of thanks, said that modern Paris was largely what it was owing to the gradual operation of the *loi d'alignement*, which came into operation as far back as 1607. That fact was some argument in favour of the proposal for the gradual carrying out of street widenings proposed by Mr. Cawston.

Mr. Leonard Stokes submitted a plan for obviating the block of traffic at Hyde Park Corner by the formation of roads at different levels crossing each other by bridges and separating the cross, through, and local traffic.

The President, in closing the discussion, referred to the necessity of some such improvement at Hyde Park Corner as that proposed by Mr. Stokes, but he strongly deprecated Mr. Cawston's proposals for "opening-up" our town parks and open spaces if "opening-up" meant cutting roads across them.

The vote of thanks to Mr. Cawston having been carried, he briefly replied, and the meeting terminated.



Illustrations.

RIPON CATHEDRAL.*

THE Abbey Church of Ripon has been a cathedral twice in its history; the original monastic church of Sir Wilfrid becoming a cathedral upon the appointment of Eadhed, or Eata, to be the first Bishop of Ripon, A.D. 678, by the then Archbishop of Canterbury, Theodore of Tarsus, after Sir Wilfrid had left his see of York. Eadhed had no successor, and the cathedral became an abbey of Augustinians, then a parish church, afterwards a collegiate church, and again in 1836 a cathedral upon the appointment of Doctor Longley to be the second bishop, and he later on succeeded the founder of Ripon Abbey, St. Wilfrid, in the mother see of York.

It is a circumstance of almost unique interest that there should be sufficient remains of a portion of the Cathedral of Eadhed of undisputed Saxon workmanship for his successor the fourth and present Bishop, to recognise as an unaltered and integral portion of the original church, and though an interval of over eleven hundred years occurred between the first and second bishop, Ripon Cathedral, as we now possess it, bridges the centuries and reaches beyond the foundation of the bishopric to the time when Wilfrid, in the seventh century, erected the church of which the crypt under the central tower now remains intact.

The historical figure of Wilfrid should not be passed over without remarking that he was one of the principal agents in effecting the adhesion of the English Church to the customs and allegiance of Rome at the great Synod of Whitby in 664, and that foreign influence was as manifest in his architecture as in the making of his tonsure, the Roman method of which was one of the great matters of discussion with the Irish Bishops at Whitby.

A settlement of Irish monks from Melrose existed at Ripon shortly before Wilfrid's time, and upon his victory at the Synod of Whitby, they retired to Iona, and King Alchfrith bestowed their monastery upon Wilfrid. Wilfrid was an Englishman, supposed to have been born near Ripon, and acquired his love of Italian methods during his frequent sojourns in the south. Before the days of the great Norman building Bishops of the eleventh century it is interesting to observe in Wilfrid an English Bishop with architectural taste and enthusiasm. He built two basilicas, one at Hexham and the other at Ripon, besides restoring and beautifying the Cathedral of St. Peter, at York, on his accesion to the See. Of his church at Ripon, Eddi, one of his chaplains who resided in the monastery, tells us that it was "a basilica of polished stone from its foundations in the earth to the top, supported on high by various columns and porticoes." And similarly of his church at Hexham that "it was supported by various pillars and porticoes, adorned with a marvellous length and height of walls, and with passages of various turnings; nor was it ever heard that such another church was erected on this side the Alps." Workmen were brought from Italy to build in the Roman manner, as the Saxon churches of that time were uniformly of wood and thatch. These descriptions and facts are entirely applicable to the work of the crypt which remains at Ripon. It is a chamber below the crossing at the position of the high altar of the earlier church, 11 ft. 3 in. long by 7 ft. 9 in. broad, covered with a cylindrical Roman vault 9 ft. 4 in. high. A round-headed window is in the middle of the eastern wall, and small niches also with round heads cut out of one stone are in each wall. Narrow passages surrounded the crypt upon the north, west, and south sides, but the latter has been blocked eastwards and extended westwards, skirting the foundation of the south-west pier of the lantern tower, and giving the present access from the nave. The original steps in the northern passage can be traced still. Mr. Micklethwaite has pointed out that Wilfrid's Church, after the Italian manner,

* This series of illustrations of the Cathedrals of England and Wales was begun in our issue of January 3, 1891. A list of those already illustrated, with particulars of future arrangements, will be found on page 102.

had the altar at the west end instead of at the east end of the church, and that the window in the east wall of the crypt was for the purpose of obtaining a view of the relics contained in the crypt from the nave, the passages descending right and left. This arrangement coincides with that of St. Peter's at Rome to-day.

There are many traditions, and theories somewhat akin to them in probability, of the purposes of this very curious crypt that we need not trouble ourselves with, the facts of greater interest and complete certainty being that the masonry is of a description far in advance of and different from that of the Saxon architecture of England, the monolithic arches, the unbroken and excellently built vault, the smooth masonry, coated with a fine and very hard plaster which takes a polish, all indicating the Italian or rather unEnglish character of the work. The non-orientation and plan prove that the Roman mission of Wilfrid was prosecuted with a thoroughness and attention to detail and precedent that would not have been unworthy of a nineteenth century ecclesiologist.

The original Irish monastery was not on the site of the present cathedral, and it appears that Wilfrid must have built two churches at Ripon, as Leland tells us that the basilica described by Eddi was at some little distance from the cathedral and was destroyed by Eadred in 948, when he devastated Northumbria. Leland goes on to say that "Odo Archbishop of Cantewarbyri (942-959) cumming ynto the northe partes hod pitie on the desolation of Ripon Chirch, and began, or causid a new work to be edified wher the minstre now is," but of Odo's building no part remained at the time of Leland's visit. Leland indeed asserts that Odo accompanied Eadred on his harrying expedition, and Odo himself relates that he took the bones of St. Wilfrid to Canterbury, out of pity to their wretched plight, but as the bones of the saint were believed to be in the shrine prepared for them by Archbishop Walter de Grey at Ripon centuries later, some little mistake must have been made by Odo in his "pitie" and zeal for treasures for his church at Canterbury.

Upon the south side of the choir, underneath the Chapter House and the vestry, there is a Norman crypt of the history of which little is known, that of the subsequent later Norman work can be traced, but this crypt and the apsidal end of the vestry above must have formed part of the Norman church of Thomas of Bayeux, the first Norman Archbishop of York (1070—1100). The position of this crypt, whether relatively the same as to the present church or below the high altar cannot be easily determined: the latter suggestion would appear most probable if the position of Wilfrid's Saxon crypt under the lantern could be reconciled with it.

The peculiar value of the architecture of Ripon Cathedral to the student is the evidence of the new vigour of English life and thought that converted the Norman into the Gothic, and in its Transition period united the characteristics of both conquerors and conquered in a national style. Sir Gilbert Scott, in his lectures on "Mediæval Architecture," has illustrated and explained the special beauties of the work of this epoch at Ripon, and the student can be earnestly recommended to study the design of the nave, transepts, and choir of the Transitional Norman Church at Ripon as an illustration of how rapidly a living architecture progresses under original conditions, unhampered by, and yet availing itself of its own past.

Archbishop Roger Pont d'Eveque (1154-1181), the partisan of Henry II. against Thomas à Becket, who described him in language worthy of a modern amateur architectural critic as "malorum omnium incentor et diabolus ille," began, *de novo*, the rebuilding of St. Wilfrid's basilica. The western and eastern bays of his nave, the transepts and the part of the choir that remains to us have all the finer qualities of the Transition style, a beauty of form begins to invade the detail and a delicacy of proportion takes the place of the massive weight of the very slightly earlier work to be seen at Fountain's Abbey close by. The solemn majesty of the latter attained by the Cistercian abstinence from ornamental features and by the huge scale of the arcades and walls, is vastly different from, but would not have robbed the work of Roger at Ripon of its own breadth and and dignity in comparison. The Ripon nave was of great width, being over 40 ft. between the walls, and had neither aisles or open arcades. The lower story of the wall was plain and featureless, a lofty blind wall arcade rose from a strong course some distance above the ground, divided into bays by vaulting shafts, and consisting of an acutely pointed arch enclosing two open arches springing from a detached central shaft. The tympanum of the enclosing arch has a pierced quatrefoil, the blind wall at back forming a triforium passage within the arcade. The clearstory above consisted of groups of three lancet arches carried on detached piers, all of equal height. The vaulting shafts rise some distance against the wall above the clearstory and carried the wooden ceiling. The first and last bays on each side of the nave which exist enable a clear idea to be obtained of the impression produced by this gracefully decorated single nave. Two arched bays at the west end open into the towers. These in Roger's time occupied the same position as the present later towers, so that the nave extended at the west front to the full width of the later aisles. The arches between the north and south walls of the towers and the nave are of later date than Roger's nave, being evidently rebuilt, but the triforium story above them and the clearstory are his work, and correspond with the design of the transepts. The nave opens into the tower with a lofty semi-circular arch, boldly moulded, springing from a delicate cluster of columns. The north and south arches of the crossing were higher than the west and east ones, not only because the sides of the tower were of unequal size, but the springing line has, in addition, been raised several feet.

Among many interesting points in the ground-plan of Ripon Cathedral are the piers of the central tower and their curious irregularities caused by the partial carrying out of their Perpendicular casing. The Norman arches remain on the north and west sides, and the south-west pier has been cased, whereas the north-west pier remains in much its original state. The north arch has a considerable deflection, as will be seen by the plan. This is not observable outside in the tower itself, the difficulty having been surmounted by corbelling it out. The eastern arm bends slightly to the work of the main axis of the nave, and this is more marked on account of the centre of the rood-screen between the eastern tower piers being considerably south of the centre line of the nave, which latter has been built, as far as its arcade is concerned, on the earlier nave walls of Archbishop Roger's Church.

The north transept remains a nearly perfect specimen of the Transitional period, but the south transept has had its arcade remodelled at the same date as the rebuilding of the tower piers.

The two eastern bays of the eastern arm of the church are of Decorated date, with a very fine eastern front, with bold buttresses and generally severe treatment on the exterior. The other bays on the north side are Transitional in style, while those on the south of the choir are Perpendicular, part of the reconstruction after the fall of the eastern central tower. The piers of the Decorated work have been very closely copied from the Transitional work which was found remaining, giving this portion of the church an earlier look than it really is.

The nave and its aisles are very spacious, being 87 ft. in width from wall to wall. At the west end there is an interesting bit of detail showing the design of Archbishop Roger's nave pretty clearly, with the Perpendicular work of the nave abutting against it on one side, and the Early English work of the western towers on the other.

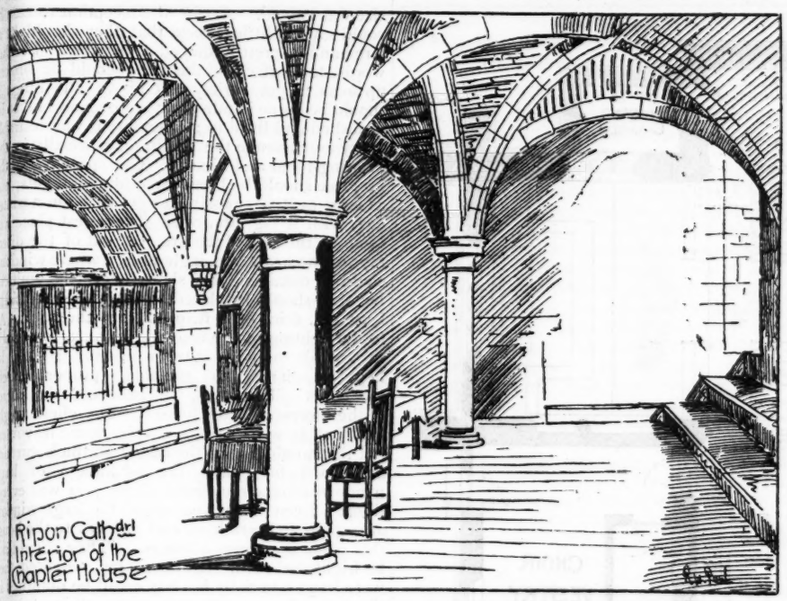
The great transepts, also of Archbishop Roger's work, are of great interest. The triforium and clearstory of pointed arches and detached columns, the large groups of corbelled, vaulting shafts, and the plain treatment of the north and south walls, the chapels in the eastern aisles, and the beautiful doorways in the western corners have all much simple beauty. The width and low proportions of the triforium arcades and the large semi-circular headed windows suggest a foreign feeling of design, but all has much that is distinctly original and English, and in comparison with Becket's shrine at Canterbury gains in national character. There is some delicate leaf carving to the capitals of the transept doors and in the chapels of the north side. The north door has a trefoiled enclosed arch springing from moulded corbels. The elevation of the north transept is the most characteristic external work of Archbishop Roger's that remains. The gable has two stories of plain semi-circular headed windows, and is flanked by lofty square turrets, which have pyramidal spire tops, with rude spindles at each angle as pinnacles. In the top of the turrets are windows, enclosed in a semi-circular arch, with a balluster mullion. This work is more Norman in feeling than the internal face of the transepts would suggest, and the turrets much resemble those of the west front of Tewkesbury. The north and west faces of the lantern tower are Roger's work, of a similarly severe Norman type. The south and east faces, together with the piers and arches below them in the crossing, were rebuilt, after a partial fall of the tower, before 1459.

The north transept is the Markenfield Chapel, and there was formerly here a chantry of St. Andrew. Of the Markenfield tombs, that in the aisle, with its eastern end against the east wall, is of the greater interest. There is some very delicate heraldic carving on the shields around the tomb, unhappily much defaced, and the effigy of Sir Thomas Markenfield (*temp.* Richard II.) wears a curious collar of "park palings," and a badge with a stag *couchant*, of which we give a sketch.

The other Markenfield tomb, against the north wall of the transept, is late and poor in detail. Just west of it is an early slab with a cross in relief.

The choir of the church of Archbishop Roger was evidently co-extensive with the existing one, so that the Cathedral has not been materially lengthened since he completed it; but most of the south side of his choir was destroyed by the fall of the tower, and the three eastern bays, excepting the arcade piers, had been rebuilt in the early Decorative style about 1288-1300.

The three western bays on the south side which were ruined about 1459, were rebuilt in the current perpendicular style. It is, however, remarkable, that in the three periods during which the choir was building, an enforced harmony with the earlier design was observed; the heights of the strings and the spacings of the bays were maintained, while the semi-circular arch which Archbishop Roger employed for his clearstory in the Transitional days is adhered to in the decorated and fifteenth-century work. The preserving of his piers to carry later arches is also remarkable. The design of the choir corresponds with that of the transepts, and its vaulted choir aisles returning on the east sides of the transepts must in conjunction with the wider aisleless nave have had a fine contrasting effect. The slender piers of the crossing, having their arches carried outwards to the width of the nave, call to mind the late Mr. Street's original treatment of modern churches for the same purpose of combining a wide congregational nave with a narrow choir. After the fall of the tower, the north-west bay of Roger's choir was sacrificed to a solid buttressing wall, and when the later perpendicular stone screen was erected against it, the choir was effectively shortened by half a bay. The vaulting shafts in the choir and its aisles should be remarked, as their bases have an interesting corbel inserted under the lowest circular moulding to carry it back to the square die upon which it rests; it is an original device for avoiding the frequent Norman angle leaf or claw, and as it diminishes the area of the base is the more suitable as a corbel. The shrine of St. Wilfrid, built by Archbishop Walter de Grey (1215-1255), owner of the well-known and beautiful tomb in the south transept of York Cathedral, stood in the eastern bay of the north choir aisle. In the south aisle wall is a long



lavatory by the door into the vestry, a not unfrequent position; another doorway westwards opens into the chapter room, which, with the adjoining vestry, was built over the Norman crypt before described. The room now called the Chapter-house and used as such is, together with the vestry east of it, a fragment of the earlier church. The vaulting and columns are, however, Early English, and the wall now dividing the Chapter-house from the vestry is also of course a later insertion, and cuts through the vaulting of the first-named portion (see plan). There are some lockers here in the north wall with their ironwork remaining, and in a glass case are three fragments of carved work retaining their original colouring, and thought to have formed part of the shrine of St. Wilfred. They were found in the choir under the floor during the restoration, and consist of two panels about 9 in. by 7 in.; one a representation of the Resurrection, and the other the Crowning of the Virgin. The former is very quaint, with soldiers in various positions round the tomb, in an earlier style of costume however than the date of the work which is evidently of the Perpendicular period. There is also a figure of a bishop, in the same case, dug up, we understand, at the same time. From the chapter-room steps descend to the crypt below, and there is an interesting chamber, either a treasury or chantry, formed in the block of buttresses at the south-east angle of the vestry.

The work of Archbishop Walter de Grey is early English of the purest phase, with an abundance of its most characteristic dog-tooth ornament. He pulled down Roger's west front and towers, of which no record or trace remains, and erected upon the same foundation the very beautiful and complete composition that we now see. The lofty west gable wall, over a hundred feet in height, consists of three stories below the gable. On the ground story are three boldly-recessed porches with fine clusters of shafts, the centre porch being the widest; each group of arches is covered with a gable. Above the porches is a tier of five elegant windows of equal height with clustered and banded shafts and much dog-tooth enrichment; the upper story also has five loftier windows gradating upwards to the centre, and a triplet fills the gable. The west end of the nave is flanked by two lofty towers continuing the façade on the same plan as the gable wall, and broken only by very severe buttresses, grouped at the angles and carried up vertically without any set-offs or splays. Three stories of arcades, of three arches each, the lower ones corresponding with those of the west gable, are repeated on each face of the towers, the centre arch being opened into a window in every story. A small blind trefoiled arcade enriches the basement. The parapets and pinnacles are later—of a debased eighteenth-century style.

Both the western and lantern towers formerly had spires of wood and lead, which were taken down in the seventeenth century to avoid the cost of repairs, but the simple broad masses and plain surfaces of the west front are so effective that it is not all suggested to the mind that they are required to complete the composition.

The lower tier of windows in the front was filled in with refined early geometrical tracery that was removed by Sir Gilbert Scott's illogical purism, though he left the terrible parapets alone.

The decorated work of the choir is of a refined but vigorous type, the small caps having a leaf enrichment; the recessing to the jambs of some of the aisle windows is particularly good, consisting of two orders of arches with a square reveal between. The east window is of great size, occupying the whole of the wall; it is boldly designed and delicately moulded. The clearstory has a double plane of tracery, as at Lincoln and Ely, and is of a very beautiful late geometrical design. A traceried arcade is carried along the east wall under the window. The sedilia now occupy the eastern bay, having been removed from the second bay; they are of later decorated work of rather heavy design, but having some fine carving.

A staircase from the south transept gives access to a Lady-chapel loft over the chapter house and vestry, into which the south choir aisle windows look. This is a simple apartment, now used as the chapter library, and has square-headed decorated windows of three lights each along the south side, and a square projecting window of five lights in the east wall over the Norman apse below. This Lady-chapel was probably erected about 1330.

The stone choir-screen is a very fine perpendicular work elaborately niched and traceried, it is of great thickness, and was possibly regarded as assisting in buttressing the lower tower piers then rebuilt. The stalls and canopies which return against it are remarkably beautiful specimens of fifteenth-century woodwork, a complete series of subsellæ of great interest and technical merit exist, also some good stall ends, notably an elephant and castle occupied by soldiers. The backs of the stalls have openings cut in them to give a view from the aisles to the altar.

There are only a few remains of the ancient stained windows, some fragments probably from the east window having been glazed into the south-west window of the nave; they are, however, of considerable beauty and interest.

The perpendicular nave is of the type of that of a fine parish church, a lofty and well-proportioned arcade carried on clustered piers of picturesque plan supports a large clearstory of traceried windows with a passage across their sills in the place of a triforium. The design is simple and good, and does not destroy the scale of the lofty and wide nave planned by Roger. The aisles are perpendicular, and connect the western towers, till then projecting beyond the church, with the transepts.

The aisles are of slightly differing date, though similar in design, the south being bolder and the north more refined in treatment. Externally the northern walls and buttresses have had more elaborate treatment than the south, but the pinnacles upon the battlements have vanished. The effect of the partial rebuilding of the tower is of a later period still, the piers and arches being coarse and weak in detail. The partial character of the rebuilding is singular, as the enlarged south-west pier of the crossing only carries its proper arch across the south transept, leaving a projecting pier in the nave to carry a larger arch that has never been built.

The extensive restorations undertaken by Sir Gilbert Scott have been most valuable to the building: he added wooden ceilings in the place of lath and plaster and papier-maché ones, and put the choir into a simple order that makes one wish that he had oftener worked under similar limitations; and excepting the unjustifiable removal of the beautiful fourteenth-century tracery from the west front the general verdict on the net result of the nineteenth-century work at Ripon will be satisfactory.

ORGAN CASE AND STALLS, MORTON CHURCH, GAINSBOROUGH.

THESE drawings show the design and arrangement of the organ case, chancel screen, and the other furniture of the chancel of this church, which has been built from the designs of Messrs. Somers Clarke and J. T. Micklethwaite.

We gave an exterior view of the church in *Builder* for October 3, 1891. For a plan of the east end see page 92.

THE PAVING IN SIENA CATHEDRAL.

THE marble paving of Siena Cathedral is quite unique, being covered with inlay representations from designs by eminent masters: scenes from Old Testament history by Domenico di Niccolo and Beccafumi of about the first half of the fifteenth century; the symbols of Siena and other towns allied with it, and a host of other figures by masters of less note.

The subject of my sketches is some of the borderings enclosing these pictorial representations, and used, if I remember rightly, in some instances, to emphasise the main lines of the plan across archways from pier to pier or respond.

It will be seen how spirited the designs are. The Tablet, with supporting "cherubim" is is inserted over one of the Scriptural subjects in the North Transept, while the other—"stag and flower vase" and "pecking bird"—designs are from the South Transept.

The execution varies. The oldest scenes are simple outlines engraved on the white marble and filled with black stucco. Shading was then introduced by the use of grey and also coloured marble, so that the inlay gradually developed into an elaborate mosaic. Most of this interesting and beautiful paving is covered by boarding, which, however, is removed once a year—on August 15 (Feast of the Assumption), and by special permission on application to the Opera del Duomo, close by the Cathedral.

T. ROGERS KITSELL.

THE ARCHITECTURAL ASSOCIATION:

PLANNING OF THE SMALL SUBURBAN HOUSE.

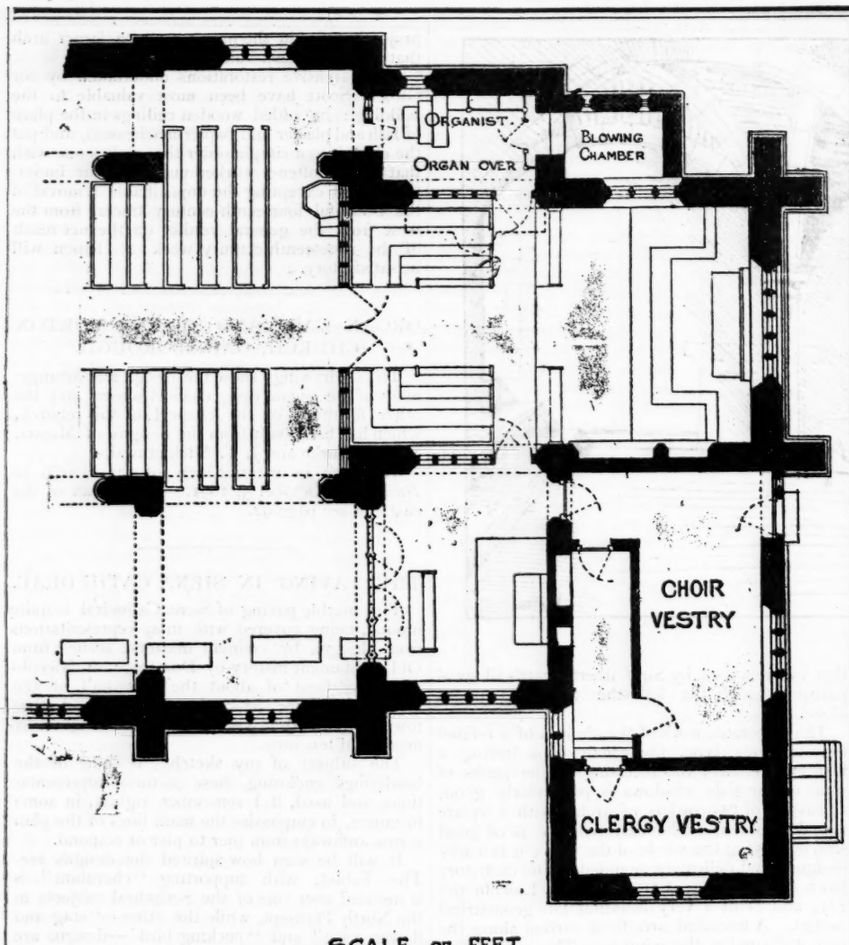
THE seventh ordinary meeting of this association for the present session was held on Friday, the 27th ult., in the hall of the Royal Institute of British Architects, Conduit-street, the President, Mr. H. O. Cresswell, in the chair.

Two gentlemen were nominated for election as members, and five were elected, viz., Messrs. H. W. H. Palmer, F. B. Chester, J. L. Findlay, C. J. S. Holcombe, and A. E. Hughes, junr.

Mr. F. T. W. Goldsmith, hon. sec., announced that the first sessional visit would be made by members on Saturday, February 11, to the Church of St. Bartholomew-the-Great, West Smithfield, when Mr. Aston Webb had kindly promised to attend and to explain the works which he had carried out there. The second sessional visit was fixed for Saturday, February 25, to the new building for the Institute of Chartered Accountants, when Mr. John Belcher, the architect of the building, would receive the members.

The President called attention to the fact that Mr. Crace's lectures on "Colour Decoration" were about to commence, but there was not yet a sufficiency of names entered for them. Unless the requisite number of names could be obtained the lectures would not be given. The President also announced that members entering the studio now could be admitted for 3*l.* 3s., instead of 5*l.* 5s. for the rest of the session.

Mr. Sydney Vacher then read a paper on "The Small Suburban House." He commenced by remarking that, although, in domestic architecture for the middle classes, we had made enormous strides since Mr. Norman Shaw, R.A., first began to show us how English



St. Paul's Church, Morton, Gainsborough.—Plan of East End.

domestic work could be treated, plenty remained to be done. Incomes were being dispersed, the towns were becoming more crowded, and every year more and more people migrated to the suburbs, and they were learning the comforts of a well and conveniently planned house. The general taste of the people was rising year by year, and the architecturally beautiful house was more in demand. The small suburban house had generally to be built at the minimum of cost, and had to contain quite the maximum of accommodation. To do such work thoroughly and well required, besides experience, a great deal of care and thought—quite as much as larger and more important buildings. The types of suburban house which he proposed to consider were those let for rentals of from 75*l.* to 130*l.*, or even 150*l.* per annum. The requirements were almost identical; the more expensive might have a fair hall, with a fireplace and two or three more bedrooms, and the other rooms generally larger in proportion; the garden might also be larger, and the situation nicer, but the general accommodation would be much the same: three reception-rooms and all offices on the ground floor; as many bedrooms as possible on the first-floor; bath-room, water-closet, housemaid's closet, and linen-closet on the first floor; and the remaining bedrooms, and box-room and tank-room, in the roof. Mr. Vacher said they should be thankful houses came before them when first commencing practice in the form of surveying commissions; he then reviewed the history of certain classes of property, and went on to describe the shortcomings and delinquencies of the jerry builder, who, he said, was largely a cerature of the grasping landowner, and who certainly seemed to hit off the popular taste for the cheap and nasty. It was a comparatively easy task, he continued, to say what to avoid, but it was a more difficult task to tell his audience what was good and what should be their aim in designing a suburban house. First of all they should bear in mind that the client might, for some unforeseen reason, have to realise his expenditure by getting rid of his house after it has been built. Let the architect, therefore, produce work that should be a commercial article, not too advanced. With regard to accommodation, the suburban householder expects always three reception rooms and the offices on the ground-floor; and four or more bedrooms on the first-floor, with bath-room, drawing-room or rooms, and as many attic bedrooms as he could get. To plan a good house it was absolutely necessary to study the site which would suggest and govern the arrangement of the rooms. Certain necessary requirements must be fulfilled before any plan could be considered satisfactory. It would not do to say that a scheme of planning was pretty if space had not been arranged for a store-room, or if the only place for the linen cupboard was in the attics, or if there were no box-room or proper tank-room. Though these seemed to be mere accessories, very much depended on them, and it was largely due to these rooms whether the house was to be a comfortable one for a good housewife to live in. The first requirement to be thought about was airiness and sweetness, for in most houses it was next to impossible to prevent the smells from the kitchen pervading everywhere. On that account he much liked the plan with the passage through the house from the front door to the back or garden door; in summer time the current of air through the house made everything pleasant and nice. The plan he had in his mind was the usual two rooms on one side of the passage, and library on the other, with offices behind, and the entrance to them under the staircase. Though a common plan, it was capable of special treatment. He did not like a plan that simply delivered one into the house with rooms all round, especially if the light to it or the staircase was from the half landing window. There was always a sense of closeness in such a house. If the architect could manage to get a hall, a ground-floor window in it was absolutely necessary, and it should be a bay if possible. A hall lit from anywhere above 6 ft. from its floor was a failure, and the space had better be utilised in making the rooms larger, for he would say that the rooms should be as large as possible. He would always sacrifice breadth for length, for by that means an appearance of size was gained. As for the reception rooms, he could say but little, except that they should be as large and as prettily shaped as possible. In other words, the surfaces of the walls should be broken up so as to get variety, but above all things it should be borne in mind that these rooms had to be furnished and lived in; therefore it was desirable to try and arrange the furniture, especially in the drawing-room and library. The space round the fireplace should be broad, free from draughts, and as large as it was possible to get it. On a winter day, with a big fire, often the cosiest place was quite by the side of the fire, but out of the direct rays of the heat. In ingle-nooks, where windows could be obtained, they should never be omitted, but they should be placed high up, with the sill at least 4 ft. 6 in. or 4 ft. 9 in. from the floor. As to the lighting of the reception rooms, especially in small houses, the windows should be kept as large as possible,—proportionately too large. That was, he believed, the secret of the success of many houses. The client might say that it would make a cold house in winter, but that would not be the case with thick curtains and good fires, and the advantage of large windows for the remainder of the year was everything. Even all the year round the large window area gives a cheerfulness and airiness to the house that made the house a success. They should not be frightened with narrow rooms, provided they were long, especially if a bay could be obtained in the site. A sense of size was everything towards comfort in the living rooms. Upstairs the bedrooms had to take their chance; the architect would have to consider how they would come when he was planning the ground-floor, and would remember that it was economical building, as well as good building, to put walls over walls, and not to have to carry the first floor internal walls on girders. The bath-room should not be less than 6 ft. 6 in. by 8 ft. to make a pleasant one, and unless it was impossible to plan otherwise they should never put the water-closet in it. Of course, the architect would be careful to make the approach to these rooms as unobtrusive as possible. Neither should the linen-closet be put in a bath-room, but it should not be forgotten that a linen-closet on a landing, or in a passage as near the principal bedrooms as possible, was essential, and it should be kept large. It should be papered with white glazed paper and made pretty. A good housewife took pride in her linen cupboard. He did not believe in running the hot water pipes through it, for they discoloured the walls and seemed to throw off tiny blacks unless covered; nevertheless, the linen cupboard should be in such a position that no damp could possibly get to it. The box-room was necessary to be as large as possible. With regard to flues, it would be well to see that an 8-in. stone ball was let down each flue when completed, and before the scaffolding was struck, to clear the flue of lumps of mortar that might have fallen and stuck; and to all top fireplaces, grates of projecting heads should be placed, that was, heads projecting in front of the bars of the grate. That would generally prevent the fires from smoking into the room. He was fond of windows over fireplaces, but each fireplace of that kind would necessitate an iron flue door outside, for sweeping. Let them beware lest the sweep insecurely fixed that flue door, for the wind would get it open, and then the chimney would smoke seriously until the mischief was found out. He generally covered the opening with a York stone lintel, and he had found no difficulty about the flue drawing from the ground floor, but on the first floor he should always use a grate with a projecting head. That arrangement was cheerful in a room, but they should not make the mistake of putting the top of the sill too high; he thought it should not be more than 4 ft. 3 in. or 4 ft. 6 in. from the floor. He preferred as a general rule to make the mantel-shelf quite high up on the wall, as it seemed to give dignity to the fireplace. Tiles for flooring of halls or passages inside a house seemed always cold and unsatisfactory; wood seemed infinitely preferable. He thought cornices were much richer looking if they were painted, and all paint-work finished with a coat of varnish, and the ceilings papered; in such rooms as the library or dining-room they need not be afraid of dark ceiling papers,—real dark papers. He would advise them to arrange for the hanging of curtains in the decoration of the rooms, either by bringing out the cornice, or working a special cornice over the window, carried up to the ceiling and fitted on the under side with curtain train-gear. If this were done with the contract it was no more expensive than the commonest poles fitted afterwards by the upholsterer. The ordinary system of running ornamental cornice round the

room and over windows, and then hiding the rest over windows in cheap houses with curtain poles, and in expensive houses with elaborately-shaped ornamental boxings, was unsatisfactory from an æsthetic point of view, and was expensive. He would also advise the use of curtain blinds instead of ordinary roller and spring blinds, and the gearing for them might be provided in the building contract. It was very simple, merely $\frac{3}{16}$ in. twisted copper wire with screws soldered on at each end and fitted with nuts to angle-iron at each end of the window. By providing windows over the fireplace of the reception room, and gearing for curtain blinds, they would get rid of two of the worst features of modern furnishing, trade pattern overmantels, and the roller blinds. The offices were as important as any part of the house, for it was getting very difficult to find satisfactory good servants, and it was not always easy to keep them; therefore, the house should be arranged so that it could be worked with as little labour as possible, and the servants' quarters should be made as comfortable as they could be. On account of expense it was generally necessary to keep the kitchen down to the smallest dimensions; 12 ft. 6 in. by 14 ft. 6 in. clear was the smallest for good houses, but as the kitchen had to be the servant's sitting-room, if possible it should be provided with a bay window, where they could sit and work; and it should be made cosy. A flue to the scullery was necessary, for either a supplemental small range or a gas oven should always be placed there. The scullery should be provided with a glazed stoneware sink, and a wood curb around it would save a great many plates from being broken. As to ventilation, there should always be a flue next to the kitchen flue to carry off smells and heated air; this flue should be at least 14 in. square. (He also tried to get a similar flue to the fireplaces of reception rooms on the ground floor, and fitted them with Sheringham Ventilators). The scullery should always lead direct from the kitchen, with no passage between, and he liked to have the coal cellar and larder leading off the scullery and, if possible, a space set aside for cleaning knives and boots, divided off by a screen. The servants' watercloset should, if possible, have the entrance under cover, and be screened. The store-room should be near the kitchen and the wine-cellar should lead out of the pantry. When it could possibly be avoided the pantry should never be made a passage from the kitchen; both the pantry and the kitchen must be separate rooms with doors of their own. A pantry next the dining-room, with a serving hatch from the kitchen to pantry, made a very workable plan. He did not like cellars, especially for larders, as it was so difficult to get a current of air through them, although with small frontages they were often necessary. As to the sanitary work generally, three water-closets were essential, one on the ground-floor for the gentlemen, one on the first-floor for the ladies, and one in the offices for the servants. As to the former, it was perhaps preferable to place it near the garden door rather than near the front door. He strongly advocated the use of a valve closet without any overflow from the porcelain basin, and with no lead trap under, delivering straight outside, with a double curve as straight as possible to the soil-pipe, which should be open at the bottom and top, and carried up at the top above all windows, as in Mr. Norman Shaw's method, published in 1877, which was the healthiest and most sanitary he knew, notwithstanding the *dicta* of the "sanitary experts," who insisted on sealing up everything hermetically and putting lead traps under the closets. He disliked wash-out closets. Having dealt with the arrangement of the hot and cold water supply, the lecturer, in conclusion, stated that he considered the interior decoration of the house of first importance, and referred to various matters of detail into which we regret that we have not space to enter.

In the discussion which followed, a great deal was said as to sanitary details, and it seemed to be agreed by most of the speakers that soil-pipes were generally made too large; a soil-pipe of 2½ in. bore was, in their opinion, quite large enough. Mr. Vacher's remark in the paper that the bed-rooms might be left to take care of themselves, and his advocacy of windows over fireplaces, were criticised; but in the course of his reply Mr. Vacher explained that he did not mean that the bed-rooms should not be carefully planned with a view to their use and the disposal of the bed and other furniture, but that they might be grouped together as convenience might dictate. As to the window over the fireplace, he liked it because it was an effectual barrier to the use of a trade-pattern over-mantel.

THE ROYAL COMMISSION ON METROPOLITAN WATER SUPPLY.*

The Chalk Areas of Kent.

WE have already given Mr. Topley's estimates of the Chalk areas of Kent east of the Kent Water Company's district, and the estimates formed jointly by Messrs. Topley, Whitaker, Easton, and Batchelor of the extent to which the Chalk water is now utilised.† From the further details supplied by Mr. Topley we select the following:—

The area between the basins of the Darent and the Medway (49 square miles out of a total of 490) has already been partially taken into consideration in estimates of future supplies for the Kent Water Company. The total estimated percolation of the Medway, Swale, and Stour is 104,500,000 gallons. In the area between the basins of the Stour and the Dour the percolation would amount to 7,000,000 gallons daily. This small area is particularly interesting, because its south-western half contributes to the springs which break out under the cliffs from Dover to St. Margaret's. Its north-westerly surface boundary appears almost to coincide with the underground water-shed, as determined by recent well-measurements by Mr. Easton. The total percolation being 7,000,000 gallons daily, the part contributing to the cliff-springs would give about 3,500,000. The amount of water actually issuing from the springs is, however, vastly in excess of this. Mr. Easton's estimate of the yield of one spring near St. Margaret's Bay, taken early on December 1 of this year, gives 2,750,000 gallons daily. Another large spring near Frenchman's Hole runs almost as strongly. This flow is, perhaps, slightly above the mean annual flow, but the Chalk springs are now rising, and the outflow will be far greater in some weeks' time. These gaugings of the springs under the cliff, however, can give only a part of the water which the area yields. Only the larger springs can be measured, and all these springs are merely the water issuing between tide-marks. The gaugings take no account of the water which must issue below low-water mark. The boring at St. Margaret's Bay proves that water, under pressure, exists in the Chalk, as the water flowed over the top of the tube just above high-water mark. If a gallery were driven a little inland from the cliffs, and a little below high-water mark, a quantity of water far in excess of that gauged on the shore could be collected. This area may be taken as a test district, and by comparison with it we may form some idea of the great amount of water to be obtained from other chalk areas in East Kent, where the chalk water enters the sea or tidal streams. It proves that the quantity of water yielded by the chalk here is much in excess of what experiments on percolation would lead us to expect; and this fits well with the evidence already given by Mr. Easton as to the Brighton area. Both here and at Brighton, however, the chalk is practically bare of drift; there may also be much water absorbed by condensation from sea-mists, in addition to the rainfall as recorded in rain-gauges. But even taking all these facts into account we are justified in concluding that the proportion of rainfall percolation into the chalk is far greater than that allowed for in these estimates, which is only about 7 in. on an average, or about a quarter of the rainfall. If the typical chalk areas of Dover and Brighton yield two-thirds of the rainfall, probably one-half of the rainfall would not be too much for the entire chalk area; all estimates of probable quantity mentioned may therefore be increased at least 50 per cent., and even then they will, perhaps, be under the mark.

Shape of the ground.—The crest of the chalk escarpment is generally over 600 ft. in height; from this crest the ground falls sharply on the south, to the outcrop of the Gault, but descends with a more gentle slope to the north and north-east, towards the lower ground occupied by the Tertiary beds. At the extreme east, from a little south of Deal to near Folkestone, the Chalk ends abruptly as sea-cliffs. The Chalk is about six miles broad in the Medway basin, from the escarpment to the Tertiary Beds; but further east, in the basin of the Stour, it covers a wider area, and has a breadth of about twelve miles from the escarpment above Folkestone to the Tertiary Beds near Sandwich.

Superficial beds over the Chalk.—The drift overlying the chalk consists mainly of clay with flints, and loam, there being but little gravel, except in the bottoms of the larger valleys, which are, or once have been, Nailbourne valleys, the streams running only after wet seasons. There are some small areas of sand (Lenham beds) near the chalk escarpment east of the River Stour; but as these are often partially underlain by clay with flints they are included in the superficial beds. Besides the Chalk areas covered with drift, we must reckon, as contributing to underground supply, those parts covered with outliers and spurs of the Tertiary beds, as well as the margins of the larger Tertiary districts; for the drainage of such small areas is to the chalk, either by direct percolation or by small surface flows.

Rainfall and percolation.—The average rainfall over this area may, perhaps, be taken at 26 in. It may be rather less over the lower ground, but it reaches 30 in. on the higher areas of the chalk. Mr. Symons, in his statement before this Commission, gives only one station within the area with which we are now concerned, that is, Knight's Place, Rochester, 320 ft. above the sea; the rainfall here is 26 in. In Mr. Symons's rainfall tables for 1866-1880, the following figures are given:—Charing, 507 ft., 30·59 in., this is near the crest of the chalk escarpment; Canterbury, 52 ft., 29·01 in.; Margate, 60 ft., 24·06 in. Below the chalk escarpment he gives Hunton Court, Maidstone, 80 ft., 26·44 in. At Hythe, 12 ft., 36·81 in. is recorded for the same period (1866-80); but it is known that there were serious errors at this station, the rainfall here recorded being much too large. In calculating the probable yield of chalk water from east Kent, Mr. Topley has assumed a percolation of 8 in. over bare chalk, and of 6 in. over covered chalk. He takes these figures because they are those used by him in former evidence before the Commission. He then, however, stated his belief that they are too low. Fuller investigation, especially as regards the area between Dover and St. Margaret's, greatly strengthens this belief, and he has no doubt that the estimates of percolation here given may safely be increased 50 per cent. If it were proposed to exhaustively pump the district, we should not count on the mean percolation for supplies, but should look rather to the percolation of dry years. But even then the estimates here given are quite within the mark.

Underground water.—The underground water of this area is disposed of in four ways:—

(*a*) By springs at the foot of the chalk escarpment; these, however, are fed only by the rain which falls near the escarpment. Folkestone, and in part Maidstone, are supplied from such springs.

(*b*) By streams, permanent in their lower parts, intermittent higher up the valleys, where they run only in wet seasons; such streams are here called "Nailbournes."

(*c*) By springs on the low ground near the Tertiary beds where the plane of saturation intersects the surface; and by springs along the sea-cliffs.

(*d*) By a general underground travel of water sea-wards.

This last is for the most part an inference. We know, however, that the chalk beneath sea-level is water-logged, and that the pressure of the inland water must be forcing the fresh water out; that springs issue along the foot of the chalk cliffs between high and low water-mark; and that water must be travelling beneath the Nailbourne valleys.

Springs along the coast.—Springs break out in great abundance at the foot of the Chalk cliffs between Dover and St. Margaret's Bay. Large areas of bright green weed occur amongst the ordinary *Fucus*. These show that fresh water breaks out in sufficient abundance to prevent the growth of the common sea-weed; in other places, where the fresh water is less abundant, the weeds grow together. The springs occasionally break out about high-water mark; but more commonly they occur between tide-marks, sometimes as fairly definite springs at one place, but more often at a multitude of places. They are thus generally difficult to gauge; but Mr. Easton has recently succeeded in gauging three—one at the south-western corner of St. Margaret's Bay, now yielding 2,750,000 gallons daily; one at Frenchman's Hole, yielding 1,500,000; and one further west, which yields over 1,000,000 gallons. These three springs alone yield over 5,000,000 gallons; but the other springs, small and large, must give a large quantity in addition to this. There are powerful springs in the Dour Valley, near Ewell, the sources of the River Dour. West of Dover there are springs, the best known being Lidden Spout, which breaks out at some distance above high-water mark. The under-cliff (known as the Warren), on the east of Folkestone, is mainly due to springs which issue from the chalk

* For previous reports of the evidence given before this Commission, see the last two volumes of the *Builder*, as per references given in footnote on page 518 of the number for December 31, 1892.

† See *Builder* for December 31 last, page 523.

near the top of the gault. A gallery has been driven at the back of the under-cliff to intercept the springs, and thus to prevent further slipping. A large quantity of water issues from the mouth of this gallery.

Springs under the Chalk Escarpment.—From Folkestone to the River Medway strong springs issue in many places. That above Folkestone yields 500,000 gallons daily to the town supply. The River Stour rises at a strong spring at Postling; there are also strong springs at Horton, at Brabourne, and near Brooke. On the west side of the River Stour there are springs at Eastwell, Westwell, Charing, and at Lenham (the head of the western branch of the Stour). In the Medway Basin there are springs at the foot of the chalk escarpment at Hollingbourne and Thurnham. Further west are the springs at Boarley and Cossington, which supply Maidstone with 600,000 gallons of chalk-water; beyond these, nearer to the River Medway, there are springs at Tottington. On the west side of the river, springs break out at Birling Place and at Trottescliffe.

Springs on the Northern Slope of the Chalk.—These, as already mentioned, are described in detail by Mr. Whitaker. The springs at Wingham are especially noteworthy; one at Dambridge was running about 3,000,000 gallons per day in November 1892; the flow of Wingham Well could not be measured, but it seemed to be quite as large as that at Dambridge. Such springs frequently break out in deep conical holes in the alluvium; they are locally known as "Nicker pits." Strong springs break out at Littlebourne. There are numerous springs near Canterbury, which are described by Mr. Dowker in his book on the water supply of East Kent. Some of these are certainly chalk springs; others are believed by him to rise from the chalk through the lower tertiary beds. At Faversham, Ospring, Teynham, and Sittingbourne, there are also strong springs. A powerful spring breaks out at Newington from the lower part of the tertiary beds; but this is, no doubt, chalk-water, and is so described by Mr. Bland. Springs rising through the marshes near Rainham seem also to be from the chalk. The springs on the bank of the Medway, under Rochester Castle, are interesting, as showing the quantity of water in the chalk, notwithstanding extensive pumping at the Rochester Waterworks and at numerous cement works in the neighbourhood.

Nailbourne Valleys.—Besides the permanent springs referred to, there are occasional flows in the main chalk valleys. These usually break out in the first instance high up the valley. The Little Stour is now running as a surface-stream in its higher part, near Lyminge. The water at Northbourne at the time of our visit (November 6) was rising, being then one foot below the surface. The Dour sometimes rises as a Nailbourne at Drillingcour, three miles and a-half above its ordinary source. The valleys near Denton and Petham are also Nailbourne valleys; the former is a tributary of the Little Stour, the latter flows into the main Stour, above Chartham. The waters of these valleys must, when not flowing as surface-streams, be running to some outlet in the main river bed, the estuary, or the sea.

Methods for obtaining the Water.—A proposal has been made to construct a tunnel near where the chalk passes under the tertiary beds at or near sea-level, and so intercept the water flowing seawards. From the River Medway to near Broughton-under-Blean, about twenty miles of tunnel might be driven, with pumping stations at intervals. These works would drain the chalk of the Medway and the Swale. From the River Stour to near Deal, about fourteen miles of tunnel would drain the Stour basin. Six miles of tunnel from Deal to near Dover would collect the water flowing direct into the sea. A large proportion of the chalk-water would be thus intercepted. Below this level no doubt there would be more water, for the abstraction of which wells with adits would be required. From the bottom of the main gallery bore-holes should be put down into the deeper beds of the chalk; and in the western part of the area these borings should be continued through the chalk and gault to the lower greensand, which would be reached at a depth of from 800 to 900 ft. below the gallery. One advantage of these bore-holes, besides the amount of lower greensand-water obtained, would be the information they would afford as to the water-bearing capacity of the chalk below the line of gallery. Where there are indications of such water in quantity, deep wells with adits might be made. Any such extensive scheme of obtaining water as is here suggested would, of course, largely diminish, and would, perhaps, often entirely stop, the run of water to chalk-wells now supplying the towns and manufactories of the district. Arrangements, would, therefore, have to be made for supplying the districts thus robbed of their water. By far the larger part of the surface chalk-water of this district now goes direct into the tidal area. Very little of it is used. There are a few mills and some water-cress beds; there are also the local waterworks which have been already named in the *Builder*.

Well-measurements.—The earliest systematic well-measurements were made in this district by Mr. Bland, who published, in 1832, the details of three lines of sections, two of them running right across the chalk-area from north to south. These measurements showed a gradual fall of the water-line from near the chalk escarpment northwards, averaging 45 and 47 ft. per mile in the two lines of sections. Some of the wells were measured twice, in June and December, 1827, and in May and December, 1828. The greatest variation recorded is 15 ft., but, no doubt, some wells would give a greater seasonal variation than this. Mr. Dowker states that at Elmsted Vicarage, on the Stour chalk-area, the water-level varies about 50 ft., being usually highest in May and lowest in December or January. During the last few weeks numerous well-measurements over the chalk-area east of the Medway have been made by Mr. Easton, who will place the results before the Commission.

Lower Greensand.—This formation occupies an area of 130 square miles in the basins of the Medway and Stour (Medway, 93.8; Stour, 36.2). Almost the whole is highly permeable, the small area of clayey Sandgate beds near Maidstone being insignificant. Powerful springs occur in many places; but it is doubtful if these could well be utilised. They are largely used by mills; and water got from wells on the Lower Greensand itself is sometimes polluted.

Salt-water in the chalk.—Where, over a large area near the sea or a tidal river, wells and borings fail to obtain supply of fresh water, whilst in many cases they yield salt-water, there is clear evidence that the travel of inland chalk-water is impeded, and that such areas are useless for water supply. This is certainly the case along the coasts of Essex and part of Suffolk. But we are not justified in drawing the same conclusion from isolated instances in which salt-water has been found in wells or borings.

The Commission will sit again on the 15th inst.

LONDON COUNTY COUNCIL.

THE usual weekly meeting of this Council was held on Tuesday afternoon last at Spring-gardens, the Chairman, Mr. John Hutton, presiding.

Resignations of Membership.—The Clerk, Mr. De la Hooke, read letters from Captain James and Mr. Æneas Smith, resigning their seats on the Council. The seats were declared vacant.

Northern Approach to the Woolwich Ferry.—The Bridges Committee presented the following report and recommendations:—

"In accordance with the instructions of the Council of the 18th October last, we have to submit particulars of various modes of embanking the river to enable the Stanley-road approach to the ferry to be widened so as to accommodate the increased traffic—1, a wall formed of timber piling, which is estimated to cost 6,000*l.*; 2, a concrete wall faced with blue bricks, which is estimated to cost 28,500*l.*; 3, a concrete wall faced with granite, which is estimated to cost 29,500*l.* The great difference in cost between the timber pile wall and the concrete walls is largely due to the unsatisfactory nature of the soil. As we informed the Council in our previous report, the ground where the wall will have to be built is of a loose and treacherous nature. A strong and substantial wall is, therefore, necessary in order that the road may be supported and prevented from slipping forward into the river. A wall made of piling is not sufficiently strong for this purpose. A few months back a portion of the existing river wall fell into the river, and soon after the cylinders of the pontoons were fixed it was found that the earth was carrying them into the river. To prevent this, ties had to be fixed to them and anchored some distance back. It therefore appears to us desirable that a concrete wall should be constructed. The value of the land that will be reclaimed has been estimated by the Valuer at 1,000*l.* In connexion with the widening of the approach, it is expedient to enlarge the area available for vehicles at that portion of the approach immediately adjacent to the ferry bridges. This can be done by the removal of the wall between the ferry approach and the upper road which forms a diversion of Stanley-road, and by sloping the surface from the land end of the bridges to the footway on the south side of Stanley-road. If this alteration were made it would, we think, be a decided improvement, as accidents frequently occur through vehicles coming in contact with the wall in the road. When the river is high, the bridge is raised so as to slope towards the shore, and horses drawing a heavy load are at times unable to keep it under control. This work will cost about 6,500*l.* We have consulted the Finance Committee with regard to meeting the expenses of the works, and it has been arranged that the cost shall be included in the Money Bill of 1893, in the event of the Council adopting our recommendation. We recommend—

'(*a*) That, subject to an estimate being submitted to the Council by the Finance Committee, as required by the statute, the Stanley-road approach to Woolwich Ferry be widened by the construction of a concrete wall with granite facing, at an estimated cost of 29,500*l.*

(*b*) That, subject to an estimate being submitted to the Council by the Finance Committee, as required by the statute, the portion of the road which is immediately adjacent to the land end of the ferry bridges be improved and levelled, at an estimated cost of 6,500*l.*'"

On recommendation *a* being put, Mr. Doubleday moved an amendment referring the matter back for further consideration, on the ground that the proposed work was too costly, and that a wall of timber piling would be sufficient. Mr. Stevens, Mr. Goodman, Col. Hughes, M.P., and the Chairman of the Bridges Committee defended the recommendation of the committee, which, with the succeeding recommendation, was ultimately agreed to.

Technical Education.—The consideration of the report of the Special Committee on Technical Education was again adjourned for a week.

Tenders.—On the recommendation of the Parks and Open Spaces Committee, tenders were accepted for the erection of conveniences for men in Finsbury Park, and for the supply of iron hurdles. We give the lists under our heading "Tenders."

The Adelphi Theatre.—The report of the Theatres and Music-halls Committee recommended that notice be served upon the owners of the Adelphi Theatre to carry out, within four months, certain structural and other alterations in the buildings. The recommendation was agreed to.

Sanger's Amphitheatre (Astley's).—The same committee reported that this theatre is in a very defective and unsafe structural condition, and "totally unfitted for the reception of the public." The Committee had reminded the licensee of the theatre of the grave responsibility which rested upon him in continuing the performances, and had informed the Lord Chamberlain of the facts. Since then, the licensee had taken some temporary measures to provide against the risk of fire. The action of the Committee was approved.

After transacting other business, the Council adjourned at 7 o'clock.

NATIONAL ASSOCIATION OF MASTER BUILDERS OF GREAT BRITAIN.

THIS Association held its thirtieth half-yearly meeting at the Midland Hotel, Derby, on Tuesday, January 24. Mr. J. C. White, the President, was in the chair, and representatives were present from London, Liverpool, Manchester, Birmingham, Nottingham, Leeds, Bradford, Northampton, Hull, Shrewsbury, Bath Leicester, Derby, The Potteries, Walsall, Huddersfield, Preston, and Portsmouth.

The Chairman reported that the usual half-yearly statements of hours worked, state of trade, and supply of labour in the principal towns of the United Kingdom, had been issued to the local associations; that during the past half-year there had been a special meeting of the Council, held at Birmingham, by request, to discuss the strike at Cardiff; and that the Council had nothing definite to report, at present, to report on the question of the long-debated Form of Conditions of Contract, except that a general agreement had at last been arrived at between the Royal Institute of British Architects and the Institute of Builders, subject to the opinions of the legal advisers of the respective institutions on the legal bearing of the clauses, and the draught was now in the hands of those gentlemen to settle between them the wording of the clauses in any case in which they may contravene the law. As soon as copies of the confirmed agreement could be obtained, they would be laid before the members.

The reports and accounts were received and adopted.

Mr. Robert Dennett (Messrs. Dennett and Ingle), of Nottingham and London, was elected President, in the place of Mr. J. C. White, of Liverpool, who retired, and Mr. Dennett thereupon delivered an inaugural address, in which he reviewed the position of the building trades generally, and referred to the proposal to erect dwellings and buildings in London by the County Council without the intervention of a contractor, a proposal which, he said, might be taken as an illustration of the lengths to which reformers or rather

theorists were prepared to go. He also discussed the subject of hours and wages.

Mr. John Bowen, Birmingham, and Mr. T. F. Rider, London, were elected Vice-Presidents, and Mr. J. C. White, Liverpool, was elected one of the Hon. Vice-Presidents for the ensuing year.

Mr. Jos. Stevenson Jones, Liverpool, was re-elected Hon. Treasurer, and Mr. C. W. Green was re-elected Hon. Auditor, and the following gentlemen were elected Members of the Council:—Birmingham, Messrs. C. H. Barnsley and W. Sapcote; Bolton, Mr. J. H. Marsden; Bradford, Messrs. W. Moulson and W. Holdsworth; Bristol, Mr. A. Krauss; Cambridge, Mr. J. Bell; Derby, Mr. J. Walker; Edinburgh, Mr. T. Bonnar; Glasgow, Mr. R. Bennett; Hull, Mr. R. Beevers; Leeds, Messrs. C. Myers and B. Mawson; Lincoln, Mr. W. H. Close; Liverpool, Messrs. J. B. Johnson and H. E. Dallow; London, Messrs. F. May and J. Burt; Manchester, Messrs. W. Southern and Alderman W. Brown; Northampton, Mr. W. H. Smith; Nottingham, Mr. Enoch Hind; Potteries and Newcastle, Mr. J. Bowden; Preston, Mr. J. Walmsley; and Wigan, Mr. C. B. Holmes.

A vote of thanks was accorded to Mr. J. C. White for the services rendered by him during the time he was President, to which Mr. White responded.

A vote of thanks was unanimously accorded to Mr. Stanley G. Bird, for the evidence given before the Royal Commission on Labour.

The following resolution was passed:—

"That in reference to the claims of the Labour Party for the insertion of clauses in building contracts for public works, relating to payment of trades' union rates of wages, prohibition of sub-contracting, and erection of work without a contractor; that it is incumbent upon this Association, and every local association, that all such action should be scrutinised, and, where necessary, opposed and otherwise directed, so as to remove, and as far as possible prevent, any injustice to the trade and loss to the public, by hastily-considered measures; and that a copy of this resolution be circulated, with a request that officers of local associations will especially note inaccurate leading articles in the press, and promptly correct any misleading assertions."

It was decided to hold the next half-yearly meeting at Huddersfield.

SURVEYORS' INSTITUTION:

STUDENTS' PRELIMINARY EXAMINATION.

Of the candidates who presented themselves at the preliminary examination of the Institution, held concurrently in London and Manchester on January 25 and 26, the following satisfied the Examiners:—

Adams, H.	Grove, A.	Oxley, A. J.
Bell, R. M.	Grove, R. T.	Pearce, C. F.
Bentley, H. E.	Hankey, G. L.	Pearse, O. B.
Berry, T. D.	Harrison, G. J. R.	Robinson, J. B. W
Birch, F. J. L.	Hawkins, A. M.	Rome, A. E.
Brown, A. F.	*Hooper, E. W.	Rook, J. T.
Burgess, H. H. P.	Howland, A. F.	Shaw, S. H.
Clarke, J. W.	Huskinson, E. A.	Shepherd, W.
Cobb, H. W.	Little, A. S.	Smith, A. P.
Cole, R. E.	Lofts, A. K.	Smith, H.
Cowell, W. L.	Lorden, L. W. C.	Southorne, C. H.
Cowin, N. T.	Lovegrove, C.	Thompson, R. O'B.
Crowther, K. N.	Luck, G. E.	Tomlinson, L.
Dickson, F. H.	Marshall, A. G.	Trueman, R. S.
Eastwood, G. H.	Martin, S. A.	Wallis, W. F.
Eldridge, P.	Miller, J.	Ward, F. E.
Evans, B.	Morrall, A. R.	White, W., Jun.
Evans, E. S.	Nettlefold, G.	Williams, L. I. S.
Foster, E. C.	Oldman, M. C.	Wilson, J.
Green, A. E.	Overell, P. W.	

* Passed at head of list.

COMPETITIONS.

LODGING-HOUSES, NEWCASTLE-ON-TYNE.—The Corporation of Newcastle-on-Tyne have appointed Mr. Chas. Barry the assessor in this competition.

ST. PANCRAS MUNICIPAL BUILDINGS.—The assessor in this competition has awarded the first place to the design by Mr. W. Harrison, of 64, Cannon-street; the second to that of Messrs. Gibson & Russell of 11 Little Queen-street; and the third to that of Messrs. R. Malcolm Stark & Rowntree, of 189, St. Vincent-street Glasgow.

THE ENGLISH IRON TRADE.—Quietness is the prevailing characteristic of the English iron market, and prices generally show little variation. Scotch makers' iron is firm; but Cleveland pig is again weaker, and No. 3 G. M. B. is quoted 3d. per ton less on the week. Finished iron, tinplates, and steel are all in sluggish sale. Shipbuilders and engineers complain of scarcity of orders. The coal trade exhibits a decided falling off.—*Iron.*

ARCHITECTURAL SOCIETIES.

ARCHITECTURAL SECTION OF THE GLASGOW PHILOSOPHICAL SOCIETY.—On Monday last a meeting of the Architectural Section of the Glasgow Philosophical Society was held in the Society's rooms, Bath-street, when a paper on "Public Library Planning" was read by Mr. George Washington Browne, A.R.S.A., Edinburgh.

NORTHERN ARCHITECTURAL ASSOCIATION.—On the 24th ult. the members of the Northern Architectural Association Students' Sketching Club held their annual exhibition of drawings in the Assembly Rooms, Barras Bridge, Newcastle. The exhibits included drawings submitted in competition for prizes offered by the Royal Institute of British Architects, and included the "Soane Medallion," the "Pugin," and the "Owen Jones" Studentships, the "Institute silver medal," and the "Association silver medal." Mr. C. S. Errington was awarded the first prize for sketches, and Mr. Tweedy secured the first prize for measured drawings. After the exhibits had been inspected, a "social" took place, Mr. J. H. Morton, F.R.I.B.A., presiding.

GLASGOW ARCHITECTURAL ASSOCIATION.—A meeting of the Glasgow Architectural Association was held in the rooms of the Association on the 24th ult., when Mr. John James Burnet, A.R.I.B.A., delivered a lecture, the subject being "The Relation of the Architect to the Craftsman." After briefly referring to the question of the training of architects and the discussion as to whether architecture was a profession or an art, the lecturer discussed the various points between architect and craftsman. In this connexion it was noted that there were two classes of contractors, the one class who were craftsmen, and the other who merely employed craftsmen, and who, in the opinion of the lecturer, were on the decrease. The system of open tendering, while having its drawbacks, was not entirely an evil, the lecturer demurring to the reflection often passed on architects and clients that really good work was by this means often found to be underpaid. In conclusion, the question of machinery was touched upon, a general knowledge of which, so far as concerned the building trades, was considered by the lecturer as of importance to the architect. A discussion followed, and at the close a hearty vote of thanks was awarded the lecturer.

Books.

The Standard Electrical Dictionary. By T. O'CONOR SLOANE, A.M., E.M., Ph.D. London: Crosby Lockwood & Son. 1893.

IT is unusual to find an index to a dictionary, the alphabetical order generally answering that purpose; but in the book before us Dr. Sloane has thought fit to add one, in order to avoid cross references. By this means, and by in every way studying conciseness, he has managed to write what is really an encyclopædia of electrical science in the compass of a dictionary. The information given is sound, and clear so far as space will permit. Had the author seen fit to omit definitions of things which have really little to do with electricity, such as the phonograph, and matters which belong to science generally, as "co-ordinates," or "the conservation of energy," he might, perhaps, have utilised his space to even better advantage; but the sciences are so closely related one to another, that it is difficult to lay down with precision the limits of any one science. Since Dr. Sloane is an American, though the book is printed in England, it would be unreasonable to quarrel with him for American spelling, however irritating it may be to English eyes. The book is well printed, well illustrated, and well up to date, and can be confidently recommended to those who like to have their science in alphabetical order.

Practical Electric-Light Fitting. By F. C. ALLSOP. London: Whittaker & Co. 1892.

MR. ALLSOP has done good service in writing this excellent practical treatise, excellent alike in matter, printing, illustrations, and arrangement. The author's aim is to be useful to the fitter, and afford information and practical hints to the householder who uses the electric light; not to write a scientific work or a text-book for students. Nevertheless he has found it impossible to altogether exclude such matters, and, where he has touched them, he is at once clear, and, save for one slip on page 7, accurate. In the second chapter the merits of the various systems of distribution are adequately discussed, and the following chapters give detailed descriptions of switches, cut-outs, wall-plugs, and such matters pertaining to a house installation. From this the author passes to the consideration of cables, joists, and methods of running the wires, and the arrangement of circuits. There are two illustrations of systems of house wiring, but in neither of them has the author cared to observe his own rule of "leads low, returns raised," nor, which is much more important, has he taken care that all the switches shall be on the same side, a matter which will become essential if the earthing of one wire ever comes in to general use, and is in any case a most desirable arrangement. After a short chapter on meters, which is, perhaps, hardly up to the high standard of the rest of the work, the rules of the Phœnix Fire Office are quoted in full, and the book concludes with a chapter on private installations, full of compressed information respecting steam engines, turbines, dynamos, and accumulators. We are glad to see that Mr. Allsop has a healthy contempt for primary battery installations, which he mentions only to condemn. We learn from the preface that "portions here and there of the book have already appeared as a series of articles in the *English Mechanic.*" We do not know, therefore, exactly when it was written, but we hardly think that Mr. Allsop would, in 1892, have recommended the switch as "the most convenient place for branch cut-outs." It is well known that the British workman has discarded adverbs, substituting a certain adjective used adverbially for them all, but it is hardly necessary that authors who write for him should do likewise; and such expressions as "arranged very similar to"; "just grip the base sufficient to"; "runs much smoother and quieter"; jar on a sensitive ear. It is odd, too, to read of a magnetic cut-out "fusing"; nor can we agree that candle-lamps "can only be detected (*sic*) from wax candles by the purity and steadiness of the light." We might point out other lapses of this kind, but the reader who is nice on such points will easily discover them for himself; and it seems ungracious to pick out all the blemishes in so useful a volume. It is not exactly a book to be read through, but as a work of reference it is invaluable.

Domestic Electric Lighting, treated from the Consumer's point of view. By ED. C. DE SEGUNDO, Assoc.-M.Inst.C.E. London: H. Alabaster, Gatehouse, & Co. 1892.

WHEN Dr. Oliver Lodge last August proposed to call a Board of Trade Unit a kilowatt, he defended the proposal on the ground that already the kilowatt per hour was often spoken of in electrical workshops. Mr. Swinburne, in replying, wrote that "the watt is never used by engineers to denote energy." If Mr. Swinburne is right, then Mr. de Segundo, though an A.-M.I.C.E., is not an engineer, for in the work before us, p. 52, we find, "the watt is the unit of energy, or of work done." It is true that on the same page we also find, "thus for commercial purposes, electricity is measured in *watts*, and 1,000 watts for one hour, or 1,000 watt-hours, is termed a Board of Trade Unit, which is sold now by the public supply companies at prices varying from 6d. to 9d." But this only proves the futility of any attempt to conciliate the inaccurate. Does Dr. Lodge suppose that if his suggestion had been adopted, and so the former of these statements made correct, Mr. de Segundo and his like would have ceased to talk of watt-hours, or to call electric energy electricity?

It may be said that it is hardly worth while to point out scientific errors in a book professedly popular and practical, but Mr. de Segundo rather provokes such criticisms by himself criticising the perfectly correct statement that "mechanical energy is transformed into electric energy" as "not scientifically accurate;" adding, on the next page, the novel law that, "by no means can the sum total of available electrical energy be increased or diminished." We wonder what Mr. de Segundo supposes becomes of the electrical energy used in his glow-lamps.

It must not, however, be inferred, because Mr. de Segundo is ignorant of the science in which he professes to instruct his readers, that the latter will find the book altogether useless. The author seems to have had some experience of house-wiring, and gives sound advice as to many details; thus he is justly severe on the senseless practice of burying electric leads in the walls. His summing up on this question is worth quoting, if only as an example of his style:—"There can be no advantage in concealing wires, however great, that is not more than counterbalanced by the risks of future trouble inseparable with such a

procedure." The tables on pp. 110 and 111 will furnish a rough guide as to cost to anyone contemplating an installation of the light in his house, and the meaning of insulation resistance is made clear by the happy analogy of water conveyed in spongy iron pipes.

The advantages of low tension are, perhaps, too strongly insisted on, and it seems absurd to say that a severe shock would be received at 50 or 100 volts.

A whole chapter is devoted to primary batteries, with especial mention of the Weymersch eell, which is recommended for country installations using one or two horse-power, though, on another page, fifteen lights or under is given as the limit at which these batteries are economical, and a Davey motor is suggested for installations of thirty or forty 8-candle-power lamps.

On the whole, there is enough practical information in these hundred odd pages to make it worth a shilling to the consumer to whom it is addressed; especially if he takes the advice contained in the first chapter—to take no step without the advice of a competent consulting engineer.

Concise and Practical Advice to Engineers, Architects, Surveyors, Contractors, and Employers. By A. A. HUDSON, Barrister. London: Waterlow & Sons.

THIS is a readable little pamphlet of rather over fifty pages, addressed in the form of quasi-letters (if the expression may be used), to the several classes of persons engaged in building operations. It is really nothing more than the pith of the author's great work—great rather in size than importance—on the "Law of Building and Engineering Contracts." Indeed, the publication of this little handbook makes one suspect that the 1,000 pages of the author's previous work have been found too many for the ordinary practitioner. The work gives an excellent summary of the general relations as established by law of the several persons interested in building contracts. A student, whether of the law or of architecture, would get a useful bird's-eye view from this *brochure*, and would be able to grapple with details with much greater ease if he had this summary in his head.

Induction Coils. A Practical Manual for Amateur Coilmakers. By G. E. BONNEY. London: Whittaker & Co. 1892.

SOME twenty years back the late Professor Fleeming Jenkin, in the preface to his work on "Electricity and Magnetism," contrasted the "Electricity of the School" with the "far more scientific" electricity of the testing office. On the principle of the survival of the fittest, the latter, enlarged and made more systematic, has now become the electricity of the schools; but in a certain class of scientific works the phraseology of the old text books still survives, having absorbed indeed, but hardly assimilated, some of the ideas of the latter science, and in the odd jargon that results the book before us is written.

If anyone wishes to make an induction coil, and to avail himself of the experience of former makers, copying their excellencies and avoiding the mistakes that they at first fell into, he could hardly take a better guide than Mr. Bonney. If he wishes to understand what he is doing in the hope that he may design a coil superior to those at present existing he could hardly take a worse guide. Mr. Swinburne's 130 volt transformer, for instance, which was last year alluded to in these columns, is in effect an induction coil, and as a piece of electrical engineering far superior to any coil described by Mr. Bonney, though it will not, like some of them, give 2-ft. sparks. Such a transformer could not possibly have been designed by anyone whose notions on the subject were derived from a book of this class.

Mr. Bonney's object is, however, to tell the amateur how to make a coil, and this object he attains, leaving nothing, however obvious, to the common-sense of the coilmaker. Thus he gravely warns him that if an insulated wire has been broken and knotted together the knob must be cut out and a joint made. He tells him too, quite rightly, to untwist any kink in the wire, though the reason he gives is rather an odd one, viz., that a kink, by hardening the copper, adds useless resistance to the coil.

One specimen of the "science" of the book must suffice:—"If, therefore, we can find the voltage of the current flowing through the primary wire of a coil, and the number of turns made by the secondary wire, then multiply the turns of wire by the voltage or E. M. F. of the current, we shall get as a total the E. M. F. of the current at the terminals of the secondary." Were this true we should increase instead of diminish the E. M. F. of the secondary by winding the primary with a wire of a higher resistance and of the same number of turns, the battery remaining the same. The chapter on batteries contains many useful practical hints, and, indeed, throughout the book whenever Mr. Bonney tells his readers what to do he is generally right, and so justifies his title of "A Practical Manual." But he should never give his reasons, for they are almost sure to be wrong.

Alden's Guide to Oxford. Oxford: Published by A. Shepherd.

THIS is a small sixpenny visitor's guide, concise and very fully illustrated. Some of the blocks are old friends and bear traces of age. They are no doubt sufficient for the purpose of identifying the buildings, but we should like to see an improvement in guide book illustrations of this kind.

The Law relating to Building Societies. By E. A. WURTZBURG, Barrister-at-Law. Second Edition. London: Stevens & Sons, Limited. 1892.

THIS is the second edition of a legal work which has attained a reputation as a sound legal treatise. It is rather a book for the lawyer than for the layman, who desires something rather less elaborate. But every solicitor to a building society will find it indispensable to him, and any layman interested in the subject will also do well to consult Appendix E, which contains a form of rules for a permanent building society. It is stated that a good feature of these rules is that very wide powers are given to the directors. In view of recent revelations, it may be doubted whether this latitude is so very desirable.

Tables of Charges on Merchandise by Railway. London: McCORQUODALE & Co.

STRANGELY enough, one effect of the revision of railway rates (the main object of which was to simplify the charging powers of the companies) has been to render a ready-reckoner more necessary than formerly. The old rates per ton were almost invariably multiples of 10d.,—*i.e.*, ½d. per cwt.—so that most calculations could be performed mentally. In fixing the revised rates, however, this principle has been entirely ignored, the exact amount chargeable being taken instead of the nearest multiple of 10d., entailing comparatively elaborate calculations. The tables published by Messrs. McCorquodale show at a glance the charge for any weight at all rates,—from 1d. to 3*l.* per ton,—and will be almost indispensable to a railway invoicing clerk, and fully worth the cost (3s. 6d.) to anyone who has much to do with checking railway accounts. Attention is drawn to the clause permitting the companies to charge fractions of a quarter of a ton as a quarter of a ton in consignments of five tons or over. They succeeded in getting this unreasonable regulation inserted in their Acts in the face of considerable opposition, and at once put it into force; but we understand they have decided to abandon it. Another regulation quoted is to the effect that consignments not exceeding 3 cwt. are charged in accordance with the classification scale. The publishers might just as well have included this scale, which would only have taken up another half a dozen pages.

The Cathedral Churches of England and Wales. By W. J. LOFTIE. London: E. Stanford. 1892.

ACCORDING to the preface, this little book "has been founded upon that of the late Mr. Mackenzie Walcott with the same name." Much has necessarily been re-written and brought up to date, and ground plans of most of the cathedrals, of somewhat varying merit, have been added. There is no plan of Bristol,—an interesting one in many respects,—and the excellent plans of the surroundings given of Norwich, Durham, and Canterbury should have included Wells, which is one of our most valuable examples of a secular church with its buildings in an unusually complete state. We notice some inaccuracies in the book which it would be well to alter in future editions. At Winchester we do not remember an effigy in Bishop Gardiner's chantry (p. 69), and the windows in the nave clearstory at Bangor are not triplets but three-light perpendicular windows. The interesting glass at Oxford representing the Martyrdom of Beckett is in the south transept chapel, not in the north. No mention is made of the beautiful fragments of S. Frideswide's Shrine, now set up in the Lady Chapel, and the description of the new glass by Mr. Burne-Jones is inaccurate as to its position. The organ is at the west end, not in the south transept. A good deal of adverse criticism on the restoration work of the late Sir Gilbert Scott might have been left out with advantage. A book of this kind should deal with facts only. It will be found a handy little volume for the visitor to our cathedrals, but it needs some revision.

Correspondence.

To the Editor of THE BUILDER.

CONCRETE FLOORS.

SIR,—It would give great pleasure to your readers to see in your last issue a letter from their old friend, Mr. T. Potter, on fireproof floors, giving us again his valuable advice and experience, "up to date" we may say; as it appears from his letter he is now in favour of a combined hollow tube and concrete floor, which I do not remember him advocating before. That he is on right lines is evident from the number of "patents" taken out lately for "fire-resisting" (an excellent name) floors, constructed with some combination of earthenware tubes and concrete.

Since writing my former letter, I have inspected one of "Ferguson's Fireproof Floors," which is on this principle, viz., two fire-clay tubes jointed in the centre fixed between rolled-iron joists with the hollow space running parallel with the joists, and thus continuous wall to wall. This, viewed in the light of Mr. Potter's letter, seems to be a step in the right direction, but I have had no experience of the floor.

Undoubtedly concrete floors must be specially adapted to individual buildings, and what is suited for one is not for another. The floors I had in my mind when writing were solid floors, and it is an open question whether they are not the simplest in most circumstances. They were executed two years ago in a small country house, where speed was an important consideration. Ordinary centreing was used, but hung from the rolled joists carrying the floor, so as to allow work to proceed in the lower rooms. The groined ends to the bays were roughly formed on the centres. The concrete was very carefully mixed *inside* the building; the aggregate consisted of six parts of tiles and brick broken rather finer than usual, and one part of Robinson's cement, the minimum amount of water being used. The bays were about 6 ft. 6 in. span, with a rise of 6 in., a thickness of 5 in. at the crown, and 11 in. at the haunches. The concrete was carefully deposited and rammed, the top was then levelled up with a finer mixture of three parts of strong sand and one of Robinson's Cement, and finished off with a layer of 1 of sand and 1 of cement. These last two layers were laid on the same day, about a week after the rough concrete was finished and were together about 2½ in. thick and formed the foundation on which kamptulicon was glued down, no boards being used. The underside of the concrete was finished in pure Robinson's cement, forming the permanent ceiling. This floor being formed all of one material, there is no tendency to separate in layers, and the ceiling is perfectly solid and hard. The work was executed during the winter, but the temperature was kept up by coke fires in the rooms below,—a very important consideration. The centreing was all removed in twenty-four hours after the rough concrete was laid. So much for construction. Now for cost. Mr. Potter thinks fireproof floors will always be more costly, but that the advantages are so great the extra money is well spent. I quite agree as to the advantages, the cost is being reduced every week, and it is open to question whether it is very much greater now than a wood floor of sound construction, with deafening, &c. The cost of the floors described above was 7s. 6d. per yard super., including ceiling, but exclusive of kamptulicon; and in the case of a country vicarage, erected about five years ago, tenders were taken two ways, one Portland cement concrete flat floors, including 2 in. by 2 in. wood joists and boarded floor, and the other way with ordinary wood joists and deafening, and the total difference in cost was under 50*l.* Several of the new patent floors are said to cost 8s. to 9s. a yard super., and a first-class wood floor will cost this.

There is a growing tendency to adopt some kind of fireproof flooring, and if more information based on systematic inquiries and experiments such as suggested by Mr. Potter were available, no doubt they would soon be used universally.

J. H. MARTINDALE.

Moor Yeat, Wetheral, January 30, 1893.

ORIENTATION OF CHURCHES.

SIR,—With reference to the correspondence on the above subject, I should like to ask Mr. Spencer how he accounts for the well-known fact that St. Albans Abbey, which, according to the theory held by him should point some 22 or 23 deg. to the *North* of East (St. Albans day being the 17th, or, according to others, the 24th, of June), does, as a

matter of fact, point about as many degrees *South* of it, *i.e.*, it stands nearly due East-South-East?

H. E. T.

SIR,—I fear that a "scientific investigation into the Orientation of Churches" would prove but a vague and vain and fruitless inquiry; for, although many churches may have been, and probably were, orientated by the rising of the sun on certain saints' days when the foundations were set out, there must have been very many, and probably the greater number, that were set out by the rising of the sun without reference to any particular day, if we take the testimony of Durandus, who wrote upon the special point referred to.

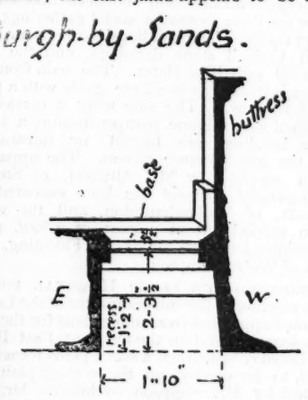
He observes that we ought to orientate our churches by the rising of the sun at the Equinoxes, and not at the Solstices as some erroneously maintain. This would preclude the possibility of any universal rule having been followed; even though many instances might be found with the saints' day orientation applying with less or greater accuracy. It would, however, still remain a doubtful question whether it were so arranged purposely or accidentally.

WILLIAM WHITE, F.S.A.

LOW SIDE WINDOWS.

SIR,—As a small contribution to the correspondence in the *Builder* on so-called "Leper" windows, I enclose a sketch plan of one at the church of Burgh-by-Sands.

It is evident from the absence of any splay on the east jamb that no view of the altar could be obtained from outside; the east jamb appears to be in its



original state, the west one may have been re-set in restoring the chancel arch over.

It might be interesting in endeavouring to account for the use of these windows to note whether the various examples have a recess below the cell inside as in the above example, also, whether these windows were originally glazed.

If I remember rightly the "Leper" window at Mitton, near Clitheroe, has the original shutter behind the (possibly more recent) glazing. This last example is unusual, being formed by a plain transome across the lower portion of a two-light thirteenth-century window.

E. H.

The Student's Column.

CHEMISTRY.—V.

WATER—(*continued*).

A WATER which contains much calcium or magnesium salt in solution is termed a *hard* water. This hardness is said to be *permanent* if due to the sulphates or chlorides, and *temporary* if due to the bicarbonates of these elements. As a rule a water contains a certain amount of both bicarbonate and sulphate. All natural waters contain a certain quantity of carbon dioxide (CO_2) which has been absorbed from the atmosphere, and it is supposed that this carbon dioxide combines chemically with the water to form a true acid thus:—

$$CO_2 + H_2O = H_2CO_3$$
(carbonic acid)

When a water containing this carbonic acid comes in contact with chalk ($CaCO_3$) it combines chemically with it to form bicarbonate of calcium thus:—

$$CaCO_3 + H_2CO_3 = CaH_2(CO_3)_2$$
(bicarbonate of calcium)

If much of this bicarbonate is present in a water it renders it hard, but the hardness caused by it is said to be temporary, because if the water is boiled the bicarbonate is decomposed, carbon dioxide is driven off, and the chalk is precipitated as a white sediment which, after a time, settles at the bottom of the vessel in which the water is boiled. The bicarbonate which caused the hardness being thus decomposed, the water is now found to be quite soft, that is, if there were no other salts in the water to form permanent hardness. The following equation represents the decomposition of the bicarbonate:—

$$CaH_2(CO_3)_2 = CaCO_3 + H_2O + CO_2$$

It is this precipitate of chalk which forms the "fur" in kettles and the scale in boilers. In some boilers, especially where sea-water is used, the scale consists partly of calcium sulphate. Instead of boiling the water, some "milk of lime" (slaked lime treated with sufficient water to make it of a thin, creamy consistency) may be added to it, and the precipitate produced allowed to stand for some hours, when it leaves the water quite clear, and settles at the bottom of the vessel containing it.

The lime (CaO) in the hydrate of lime (slaked lime) combines with the carbon dioxide in the calcium bicarbonate to form calcium carbonate, thus—

$$CaH_2(CO_3)_2 + CaH_2O_2 = 2CaCO_3 + 2H_2O$$
(slaked lime)

Both the original chalk dissolved in the water and that produced by adding the slaked lime are, therefore, deposited together.

This process, which was invented by Dr. Clark, is used on a large scale at Canterbury, Caterham, and other districts for softening the water supply. Hardness due to sulphates, chlorides, &c., is said to be *permanent*, because it cannot be removed by any process that could be adopted for practical use on a large scale without rendering the water unfit for drinking. A hard water will not produce a lather with soap until a large proportion of the latter has been put into it, and if the hardness is due to sulphates a large quantity of soap is destroyed before it begins to exercise any cleansing action.

The degree of hardness in a water is determined by noting what quantity of a standard solution of soap is required to produce a permanent lather.

Soft water should not be allowed to come into contact with lead, because it dissolves small quantities of it, forming lead carbonate. Lead carbonate is an accumulative poison, that is to say, minute quantities of it when taken constantly at comparatively short intervals do not pass out through the body, but collect or accumulate in the system until a sufficient number of small doses have been taken to produce poisoning. Where rain water or very soft water is supplied, it is therefore necessary to avoid lead pipes and cisterns, and to use cement, stoneware, or slate cisterns and iron pipes.

Hard waters do not act upon lead.

POTABLE WATER.

Waters which contain much organic matter, together with a considerable amount of chlorine, ammonia, and nitrates, are, as a rule, unfit for drinking purposes. A good drinking water should not contain more than about 30 grains of total mineral matter in a gallon.

Experiments. Group 3.

QUALITATIVE EXAMINATION OF POTABLE WATER.

(1) *Colour.*—If seen in a glass tumbler it should be colourless and quite clear. It is better examined through a glass tube of not less than 2 ft. in length, when it should appear of a clear pale blue or greenish colour. Peaty matter, which may be quite harmless, sometimes occurs in a natural water and causes it to appear of a dark brown colour. A water which possesses a yellow or a greenish-yellow colour is the most suspicious.

(2) *Taste and Smell.*—Half fill a *clean* glass-stoppered bottle with the water, place stopper in position, and warm the water slightly. Shake bottle, and observe if any perceptible odour is emitted upon removing the stopper. Also note whether the water possesses any taste. A drinking water should be odourless and tasteless.

(3) *Lead.*—Fill a small clean tumbler or tea-cup with the water, add a few drops of hydrochloric acid, and then some solution of sulphuretted hydrogen, or pass some sulphuretted hydrogen gas through it. If the water acquires a *brown* tint it indicates the presence of lead.

(4) *Mineral Matter and Organic Matter.*—In a porcelain basin evaporate about a pint of the water to dryness. The residue should be quite white in appearance, and if the water is to be used for washing purposes there should not be much of it. Now heat the residue in the porcelain basin over a spirit flame or a Bunsen gas flame. If the residue darkens much in colour, it indicates the presence of organic matter. If, at the same time, a disagreeable odour resembling that of burnt feathers is given off, the organic matter is almost certain to be of a dangerous nature.

(5) *Organic Matter.*—Another good test for the presence of organic matter is the following:—Fill a clean tumbler or tea-cup with the water, add a few drops of sulphuric acid, stir with a clean glass rod or tube, then add enough very dilute solution of potassium permanganate to impart a distinct pink colour to the water. If little or no organic matter is present in the water the pink colour will remain for a long time, but if the colour fades rapidly a considerable amount of organic matter is present.

(6) *Chlorine.*—Partly fill a tumbler with the water, add a few drops of nitric acid and a few drops of silver nitrate solution. Stir with a glass rod or tube. The water should remain clear or should only become cloudy. If a white curdy precipitate is produced, it is a suspicious indication.

Natural waters, except those close to the sea or near salt mines, seldom contain much chlorine, but urine contains a considerable quantity of it as common salt (Na Cl). The presence, therefore, of much chlorine, although by no means a positive proof of contamination with sewage, is a useful indication when considered in conjunction with the ammonia and organic matter.

(7) *Ammonia.*—The presence of ammonia in a water is immediately shown by the addition of a re-agent known as "Nessler-test" which consists of an alkaline solution of potassium and mercury iodides. It may be bought ready for use at the shops of most operative chemists.

Fill a clean, tall jar or tumbler of colourless glass with the water and stand it upon a white tile or sheet of white paper. Add a few drops of Nessler-test. If only a small quantity of ammonia, such as is found in good water, is present, a pale straw colour will be produced. If a suspiciously large quantity is present, a brown colouration will be produced. A water that has recently been contaminated with sewage will be found, by the application of the above tests, to contain considerable quantities of organic matter, chlorine, and ammonia.

Tests for Chalk and Sulphate of Lime.

Small quantities of chalk, or carbonate of lime, or of sulphate of lime, do not affect its value for drinking purposes. For washing and boiler purposes, however, the less the quantity of these salts in it the greater is the value of the water. Water containing large quantities of these salts, say 100 grains per gallon, is, then, unsuitable even for drinking purposes.

8. *Chalk.*—In a glass beaker boil, say, 2 pints of the water for about half-an-hour, preventing the water from diminishing much in bulk by adding small quantities of distilled water to it from time to time. If bicarbonate of calcium was present in appreciable quantity in the water, a deposit of chalk, or, more correctly, of carbonate of lime, will settle at the bottom of the vessel when removed from the source of heat. Allow this sediment to completely settle, and then pour off the clear water into another clean glass beaker. To the sediment in the beaker add a few drops of dilute hydrochloric acid, when, if it is a carbonate, a brisk effervescence will be caused, owing to the rapid evolution of carbon dioxide from it. In a very hard water a considerable amount of chalk is generally thrown down. Filter the water which was poured off through a filter paper, and treat the clear filtrate as follows:—

9. *Sulphate of Lime.*—Boil the clear filtrate, and, while boiling, add a few drops of hydrochloric acid, then excess of ammonia. If a flocculent *brown* precipitate is produced at this stage, it indicates the presence of iron. Finally, to the solution add some oxalate of ammonia solution. If much sulphate of lime is present, a heavy white precipitate of oxalate of lime will be formed. Boil another pint of the water in a glass beaker or flask, add a few drops of hydrochloric acid, and then some solution of barium chloride. If sulphate of lime is present in the water, a white precipitate of barium sulphate will be produced.

Storage and Filtration of Water.

Whenever it is necessary to store drinking water, it should be received in a *clean* cistern, which should be situated in some place where it can be conveniently and frequently inspected. Nor is it sufficient that the cistern at starting is clean, for unless it is frequently subjected to a thorough cleansing some of the unwholesome matter which is always liable to find its way into a cistern is sure to accumulate and putrefy. A cistern containing drinking water should not be placed in a dwelling-room, in a damp unventilated cellar, or immediately over a water-closet, nor should it be

connected in any way with any drain, sewer, or water-closet. For the filtration of water on a large scale, clean, sharp gravel or sand is generally employed. When properly used it forms a cheap and efficient material for removing all suspended matter, and has in addition a slight purifying action upon the organic matter in the water. As a rule, the water which is supplied to large towns is first run into large reservoirs or "settling tanks," where the heaviest portions of the suspended matter fall to the bottom of the tanks by gravitation. The water thus partially clarified is then passed on to the filter beds, which are usually composed of layers of sand and gravel, the total depth of a bed being usually between 6 ft. and 8 ft.

For filtration on a small scale, charcoal is usually employed, and of all the kinds of charcoal, animal charcoal ranks the highest as an efficient water purifier, that is, of course, when the animal charcoal is properly prepared.

Animal charcoal not only purifies water by removing suspended matter, but the oxygen in its pores also acts chemically upon the dissolved organic bodies. The oxygen renders them harmless by oxidising them, and thus removes one of the most dangerous impurities of a water.

In some filters a mixture of animal charcoal and sand is used, and proves to be an efficient water purifier. Of late years spongy iron has been shown to be one of the most efficient purifying materials discovered. It has been much recommended by scientific men, but does not appear to have yet come into very general use.

When kept clean, domestic filters undoubtedly exercise a beneficial influence upon impure water, and may be the cause of preventing the spread of typhoid fever or cholera in a house, to say nothing of minor diseases; but, at the same time, it must not be forgotten that a dirty filter is *worse than useless*, and may, in fact, form a breeding-house for the very germs it is necessary should be destroyed. It should form the duty of one of the members of every household to remove the filtering medium from the domestic filter once a week, or at any rate once a fortnight, and, if it is to be again used, to boil it well in water, wash it, and, finally, bake it in the oven. If this was done, we should hear very little about inefficient filters.

Hydroxyl H_2O_2, *or Hydrogen peroxide.*

This oxide of hydrogen is a colourless, syrupy liquid which decomposes very easily into oxygen and water. It is a powerful oxidising substance, and is much used for cleaning pictures the paint of which has become darkened by sulphur compounds from coal and gas. These sulphur compounds convert white lead paint into black lead sulph*ide*, which when acted upon by peroxide of hydrogen is oxidised to sulph*ate* of lead, which is white, thus:—

$$PbS + 4H_2O_2 = PbSO_4 + 4H_2O$$

and, therefore, the white paint in the picture is restored to its original colour.

Peroxide of hydrogen is also a powerful bleaching agent; the pure material will completely bleach hair, while a dilute solution of it turns the hair yellow.

Dilute solutions of it are, consequently, much used in the preparation of "golden" hair dyes.

Being a powerful oxidising substance, hydrogen peroxide necessarily forms a disinfectant, and is found to be very effective although somewhat expensive. It is said to be the most important ingredient in "Sanitas."

In many of its properties, hydrogen peroxide resembles ozone, but while the former is soluble in water, ozone is almost insoluble in it. There are several methods of preparing hydroxyl, one of which is that of passing a current of carbon dioxide gas through water containing barium dioxide in suspension.

Insoluble barium carbonate is formed and settles as a white sediment, while the hydrogen peroxide, which is also formed, being soluble, remains in the water as a clear, colourless solution. The greater part of the water in this solution may be removed by evaporation under the receiver of an air-pump.

$$BaO_2 + CO_2 + H_2O = BaCO_3 + H_2O_2.$$

GENERAL BUILDING NEWS.

THE SHIPPING EXCHANGE, BILLITER-STREET.—This building was opened on Monday last by the Lord Mayor. It has been formed out of Nos. 19, 20, and 21, Billiter-street, E.C. These buildings were erected about twenty-five years ago, and have a stone front, the portion taken by the Shipping Exchange being the whole of the ground floor and part of the first floor; and in order to obtain a large room on the ground floor a thick wall with fireplaces has been removed, the upper portion of the wall and fireplaces being supported on steel girders and iron columns. The removal of this wall has given a fine room about 90 ft. long, 34 ft. wide, and 14 ft. high. The central entrance to the building has been retained, and a new lobby has been formed, enclosed in mahogany, for the members to pass in and out. The ground floor room, which is intended to be used for the Exchange proper, is warmed with two of Captain Galton's patent stoves, with descending flues made by Messrs. Yates, Haywood, & Co., and new water-closets, lavatories, and urinals have been fitted up at one end of the room by Messrs. Doulton & Co. From the ground floor to the first floor a wide staircase has been constructed, having teak newels, walnut strings, balusters, and rails, and the treads are covered with indiarubber. The first floor room is intended to be used principally as a luncheon and reading room, and has a bar fitted up by Mr. Heath, of Rahere-street, Goswell-road, E.C. The whole has been lighted by electricity, and provision has been made for gas should the electric light fail at any time. The whole of the rooms have been redecorated. The general works have been carried out by Messrs. Cubitt & Co., of Gray's Inn-road, W.C., under the personal supervision of the architect, Mr. Alex. R. Stenning, F.R.I.B.A., of Cannon-street. Messrs. Moreland & Son supplied the steel girders and iron columns, and the electric light is by Messrs. Pritchett & Co., of Soho-square.

RESTORATION WORKS, BRISTOL CATHEDRAL.—According to the Bristol papers, the work of restoring the tower of Bristol Cathedral and the equally dilapidated Lady chapel, built in the first half of the thirteenth century, is about to be commenced. The contract, which has been secured by Messrs. W. H. Cowlin & Son, is for 6,500*l.*, and it will be carried out under the supervision of Mr. J. L. Pearson, R.A. The foundations of the tower received attention some years ago, but the tower itself, built in the fifteenth century, has its external stonework in such a crumbling condition that it is considered necessary to take out stone after stone, and substitute new stone, and as this will have to be done from base to summit, the work will probably occupy twelve months. The parapets of the tower,—taken down many years ago,—will be revived as far as possible in exactly the same design. The Lady chapel, which has been out of use some years, will have its whitewashed and damaged stonework replaced by new stone, and all the dilapidations will be made good, the work occupying probably four or five months.

SWIMMING BATH, &C., TORQUAY.—At a special meeting of the Torquay Town Council, held on Monday last, it was unanimously resolved that the design submitted by the Borough Engineer (Mr. H. A. Garrett) for the erection of a tepid swimming bath adjoining the present private baths and assembly room, at an estimated cost not exceeding 4,000*l.*, be approved, and that an application be made to the Local Government Board for powers to borrow the necessary amount. The bath will be 90 ft. long by 36 ft. wide, and the sea water required for the purpose will be obtained from the sea adjoining the Ladies' Bathing Cove. It is also proposed that the boiler power for pumping purposes will be of sufficient power to generate electricity for lighting the new and existing building throughout by the electric light.——At the same meeting it was also resolved to apply for powers to borrow the sum of 5,000*l.* for the purpose of the widening and improvement of the Fish and Coal Quays, plans for which had been prepared by the Borough Engineer and approved by the Harbour Committee.

WORKS AT KIRKSTALL ABBEY.—The members of the Sub-Corporate Property Committee of the Leeds Corporation having charge of the Abbey ruins and grounds at Kirkstall visited them on the 30th ult. They were met by Mr. Micklethwaite, architect, of London, under whose instructions the work of preserving the ruins has been proceeding during the last few months. As has been previously stated, the most dangerous part of the ruins is the tower, and it was to this particular portion that Mr. Micklethwaite directed the attention of the Committee. Eventually the members passed a resolution recommending the Council to allow the erection of certain buttresses, and also the construction of an arch across the transept. These, it was said, would considerably add to the security of the tower.

TOWER, ST. MARGARET'S CHURCH, ISFIELD.—The tower of St. Margaret's Church, Isfield, near Lewes, is about to be restored as a memorial, under the direction of Mr. John Rawlinson, of London, at a cost of about 650*l.*

NEW POLICE STATION, HANDSWORTH, NEAR BIRMINGHAM.—The Staffordshire County Council have decided upon erecting a police station, with court and other accommodation, in Thornhill-road, Handsworth, and have accepted the tender of Mr. Whitehouse, contractor, of Birmingham, for the same. The whole of the buildings are expected to be completed by November 30 next, under the superintendence of the architect, Mr. John P. Osborne, also of Birmingham.

PROPOSED INFECTIOUS DISEASES HOSPITALS FOR PLYMOUTH.—Mr. S. J. Smith, C.E., one of the Local Government Board Inspectors, and Mr. T. W. Thompson, of the Medical Department, held an inquiry at Plymouth Guildhall, on the 28th ult., into an application by the County Borough Council for leave to borrow 32,000*l.* for the purpose of providing hospitals for infectious diseases. The Town Clerk (Mr. J. H. Ellis), alluding to the proposed hospital in Mount Gould-road, said they were all pretty well agreed as to the site. The ground sloped towards the south, and would be connected with the new sewerage scheme, so that it would be efficiently drained. It would also have the Borough water supply. Mr. Bellamy, Borough Surveyor, produced plans of the proposed hospital. The cost of the hospital would be 30,000*l.*

PROPOSED NEW ART SCHOOL AT THE YORKSHIRE COLLEGE.—We understand that plans have been prepared by Messrs. Waterhouse & Son, architects, of London, for a new art school in connexion with the Yorkshire College. The site of the proposed school, which is quite independent of the buildings now in course of erection in College-road, will be a plot of ground on the north side of the block of the institution used for textile purposes. The building, which will include a general art room, "life" class-room, and a private studio, will furnish ample accommodation for all the classes.—*Yorkshire Weekly Post.*

CHURCH INSTITUTE, WOLVERHAMPTON.—On the 28th ult. the Bishop of Lichfield dedicated the new Church Institute connected with St. Peter's Collegiate Church, Wolverhampton. The buildings consist of a two-story main block, with a side wing formed into a tower. The main block contains on the ground floor a large guild room, a library, and two class-rooms, over which is the large hall, 67 ft. 6 in. by 32 ft., approached at either end by a wide and easy staircase. In the side wing is the principal entrance and staircase, and on the first floor are three rooms for social gatherings, &c., and store rooms. The buildings are built in red bricks with Codsall stone dressings, and the roofs are covered with blue slates. The main front next the street is treated as one large gable with a projecting oriel window. The side wing is carried up and finished with a stone parapet forming a low tower. The buildings are heated by hot-water pipes on the low pressure system. The apparatus has been supplied by Mr. Allwood, of Stourbridge. The general contract has been executed by Mr. Lovatt, of Wolverhampton, and the whole has been carried out at a cost of 2,600*l.* under the superintendence of Mr. T. H. Fleeming, architect, also of Wolverhampton.

PROPOSED NEW FEVER HOSPITAL FOR LEITH.—A meeting of the sub-committee of the Leith Town Council appointed to examine plans for the proposed new fever hospital for the burgh at East Pilton met on Tuesday last, when a set of plans for a fever hospital, to be erected on the cottage plan, was submitted by Mr. Simpson, architect. Mr. Simpson estimated that the buildings would cost about 20,000*l.* and general furnishings, &c., about 4,000*l.* more, exclusive of the cost of the site, for which upwards of 3,000*l.* have been paid. After having examined the plans, the committee approved of them, with some slight alterations.

SANITARY AND ENGINEERING NEWS.

CHESHUNT WATERWORKS.—On Thursday, January 26, a special meeting of the Cheshunt Local Board was held at the Newgate-street pumping-station, for the purpose of witnessing the official trials of the now completed pumping machinery. The trials were conducted by Mr. Bennett on behalf of the Board, and Mr. Thom on behalf of the makers (Messrs. Yates & Thom, Canal Foundry, Blackburn). The contract was for each engine and pump to be capable of raising 80 cubic ft. (or 500 gallons) per minute, through a rising main 10 in. in diameter, into a reservoir a distance of 850 yards, the lift being 425 ft., with not more than thirty revolutions per minute. The first engine was started at 10.40, at twenty-four revolutions, with steam at a pressure of 70 lb.; the trials were brought to a close at 12·40. The speed was never increased beyond twenty-four revolutions, the actual quantity of water raised being 578 gallons per minute for each engine, or at the rate of 1,039,680 gallons per twenty-four hours when running full speed, or one-third in excess of the specified duty. On the conclusion of the trials Mr. Paul congratulated Mr. Bennett and Mr. Thom on the most excellent results and the satisfactory completion of the works. The whole of the works now completed embrace deep well engines, pumping-station, covered service reservoir, and about seventeen miles of water mains, and were designed by Mr. Bennett, Assoc.Mem.Inst.C.E., the expenditure being 32,000*l.*, and will eventually prove a very valuable source of revenue.

PORTISHEAD DRAINAGE.—We understand that Mr. T. J. Moss Flower, of Bristol, has been instructed to devise a scheme of drainage for the whole Local Board District of Portishead, and to prepare plans, specifications, and estimates.

GLASGOW WATERWORKS EXTENSION.—The tender of Messrs. Morrison & Mason, Limited, to construct the Blackrigg section of the new aqueduct from Loch Katrine to Glasgow for 86,700*l.* was accepted by the Glasgow Corporation on Monday.

STAINED GLASS AND DECORATION.

WINDOW, ST. MARY'S CHURCH, LITTLETON-ON-SEVERN.—The parish church of St. Mary, Littleton-on-Severn, has just received the addition of a stained glass east window in the chancel, erected to the memory of the late Mr. Robert Cann Lippincott, of Over Court. The work has been carried out by Messrs. Joseph Bell & Sons, of Bristol.

WINDOW, LICHFIELD CATHEDRAL.—On the 29th ult. the dedication took place of the new window which has been placed in the north transept of Lichfield Cathedral. The work has been carried out by Messrs. Clayton & Bell, of London, and has occupied upwards of a year. It is a five-lancet window representing the Tree of Jesse, and the long line of kings commencing with David and concluding with Christ.

FOREIGN AND COLONIAL.

FRANCE.—The demolition of the Galérie des Machines in the Champ de Mars is seriously talked of, owing to the cost of keeping it up and the impossibility of utilising it.——The Minister of Fine Arts has commissioned M. Daumet to go to Lille, with M. Roger Marx, Inspector of Fine Arts, to inquire into the state of the collections in the museum of that town. The reason is a report that the bad conditions of heating and ventilation in the galleries have had a very pernicious effect on their contents. M. Daumet reports that the case has been much exaggerated, and that proper precautions were being taken for the preservation of the objects.—The "Union Artistique" of Toulouse is to open on March 15 its ninth annual exhibition of painting and sculpture.——The town of Nice is about to open a competition for all French artists for a design for a monument in commemoration of the first union of the province of Nice with France in 1793. The monument is to be erected in the new public garden opposite the Municipal Casino. A sum of 72,000 francs has been voted for the cost of the monument, which is to be completed *in situ* on April 1, 1894.——The Government has decreed the "public utility" of a railway on the Crémaillière system between Monaco and Turbia. The railway, which will start from the plateau de Carnier, will follow the course of the valley of Sainte Devote to arrive at the platform found on the level of the commune of Turbia.——The operation of deepening the Vauban dock, in the harbour of Havre, is to be commenced shortly.——A public competition has been opened at Marseilles for the construction of new docks and warehouses.——An iron bridge for foot passengers is to be formed over the Saone, at Lyons.——A new canal and basin are to be opened shortly in the port of Tunis.——The recent falls of snow and hail have caused serious damage to the new reservoir for the waters of the Arve at St. Cloud.

MELBOURNE.—The *Building and Engineering Journal*, of Melbourne, gives an account of the extensive sewerage works now in course of construction from the rising main at Brooklyn to the Sewage Farm at Werribee by the Melbourne Metropolitan Board of Works. The total length of the outfall sewer is about sixteen miles, from the rising main to the sewage farm, or 1,280 chains. Part of this is wholly covered, being built of of 9 in. concrete lined with brick and concrete, and is 11 ft. in diameter, the remaining parts being of open concrete, but it is contemplated to eventually cover the whole. At present the discharging capacity of the sewer is equal to 80,000,000 gallons per day, but when the whole is covered this capacity will be about double. Up to the present 121 chains of open concrete have been completed, 68 of covered concrete, 58 of covered brick, and 46 of open brickwork, and the whole cost is upwards of 230,000*l*. Mr. Thwaites is the Chief Engineer.

MISCELLANEOUS.

ARCHITECTURAL ASSOCIATION: DISCUSSION SECTION.—The sixth meeting of the session was held at the Rooms of the Association on Wednesday evening, the 1st inst. A paper was read by Mr. J. C. Stockdale on "Roof Coverings," with special reference to slates and tiles. The subject was treated in a comprehensive manner, and was well illustrated with diagrams and samples of material contributed for the purpose by Messrs. Ashton & Green. In the discussion which followed, and which was opened by Mr. W. Bonner Hopkins, Mr. Lacy Ridge, the special Visitor, gave some interesting details from his own experience, and Mr. Ernest Mathews added some useful practical hints.

A FURNITURE AND ALLIED TRADES' EXHIBITION will be held in the Royal Agricultural Hall, Islington, during the week from April 6 to April 15. The Exhibition will include timber and wood-working machinery.

DEPUTATION OF PLUMBERS FROM LINCOLN.—A deputation, introduced by Mr. W. Watkins, F.R.I.B.A. (ex-Mayor of Lincoln), composed of about thirty master and operative plumbers from Lincoln, Grantham, and Lincolnshire, visited London last week to inspect the Museum of Sanitary Appliances and Testing Department in connexion therewith, established by the Hornsey Local Board at Highgate. The deputation afterwards waited on the Lord Mayor, at the Mansion House, who said he was pleased to learn that the Corporation of Lincoln were doing their utmost to promote sanitary science. Referring to the visit of the deputation earlier in the day to the Highgate Museum and Testing Department, which he had the pleasure of opening a short time ago, he said it was undoubtedly a step in the right direction for a public body like the Hornsey Local Board to found, as it were, a museum for the technical study of plumbing work, and the presence of that deputation from Lincolnshire was an evidence that the intelligent and public-spirited action of the Board was already bearing fruit.

DOULTON'S SELF-ADJUSTING PIPE-JOINT.—The patentees have made an important improvement in this joint, the drawback to which in its original form was the small amount of contact between the two surfaces as shown in the accompanying section (Fig. 1). The joint in this form was made by the contact of two bands of composition, cast—one on the spigot and the other in the socket of the pipes, producing a mechanical fit, no cement being used. The advantage claimed is that the risk from faulty workmanship is reduced to a minimum, as the two curved surfaces allow the pipe to dip a little without deranging the joint. We are rather disposed to think that this is a wrong principle; that necessity of proper laying should be considered first, and that so small a part of contact as is shown in this section is not desirable and does not allow sufficient margin for possible decay or abrasion of the composition. We presume that the patentees have recognised that there is some ground for this objection, as the improvement which they now announce, shown in the other section, (Fig. 2) consists in the interposition of a seating-ring of compressible material between the two surfaces, the extent of the contact being thus increased, without altering the simplicity of the original form of the joint. In this form the joint appears to us much more reliable. The patentees state that "the question of the material of the seating-ring has been the subject of careful consideration, and an eminent chemical authority has been engaged on a prolonged series of experiments in order to thoroughly test its durability, and that the result has been to show that it is unaffected by both alkaline and acid solutions of a strength far in excess of anything to be met with in sewage."

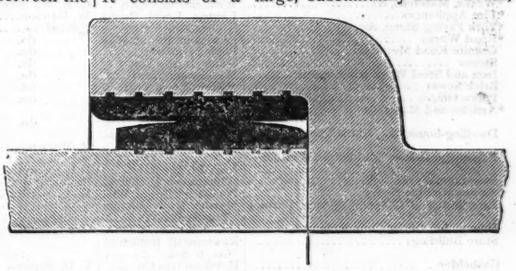


Fig. 1.

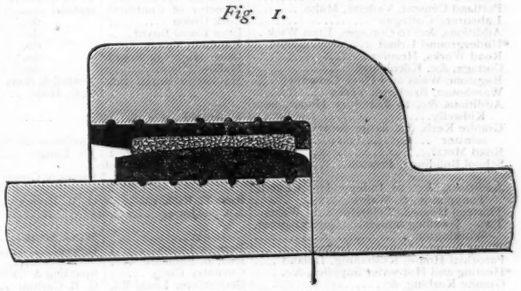


Fig. 2.

IRON-LATHING SHEETS.—Messrs. Cunnah, Wright, & Company have made some improvements in their machinery for producing these sheets, which are not corrugated in the ordinary undulated form, but bent into a section like a series of dovetails, thus retaining a grip on any plastic material which has been applied to them when in a soft state.

AN ARCHÆOLOGIST'S UNEXPECTED WEALTH.—Mr. E. Ingress Bell, in a letter to the *Spectator* for January 28, writes:—"I have heard it said by a friend of the late Albert Way, the well-known archæologist, that he came by a fortune in this wise. Crossing Pall Mall, he cannoned against an old gentleman, and discomfited him. After mutual apologies and the interchange of civilities, cards were exchanged, and on each card was imprinted 'Mr. Albert Way.' The older gentleman dying, had no natural heir, and left his fortune to the other Albert Way."

GRANITE AND RAILWAY RATES.—The Leicestershire granite industry is likely to suffer very materially unless the railway rates on road metal are considerably modified. On Tuesday last (31st ult.) important action was taken by the Holland (Lincolnshire) County Council at Spalding relative to the increased rates. The Council require the carriage of 17,000 tons of granite, but owing to the present exorbitant rates it was found that it would be cheaper to procure the supply of road metal, &c., from Belgium by water, rather than from Leicestershire by rail. It was decided to refuse to pay the new rate, and in the event of the companies declining to revert to theold charges the Council will purchase the Belgian granite. Taken by itself, this, of course, is not a matter of much moment, but we fear that the example set by the Holland County Council will soon be followed by other bodies, to the general detriment of the Leicestershire granite trade. It is said that the loss of the traffic into Lincolnshire will be a serious matter for the railway companies concerned; if that is so, no doubt they will see their way to meet the demands of the Council, and thus keep the trade as much as possible in this country,—it is needed. We may remark that if the Council should ultimately be compelled to have the Belgian granite, they would probably get the Quenast stone, for no other rock of the nature of granite is quarried to any extent for export purposes in Belgium, so far as we are aware. It is a quartz diorite, having a porphyritic structure, the crystals being small but prominent; it is very hard and compact, and in every way forms excellent road metal and paving setts,—a formidable rival to the English stone.

THE PROPOSED MUSEUM FOR BUCKINGHAMSHIRE.—The sub-committee charged with the formation of a county museum for Buckinghamshire have issued a statement about the scheme. A site was selected in Aylesbury. It was formerly occupied by a brewery, and stands detached. The price was 555*l*. A building erected on the spot could be seen from the market-place. Mr. Robert Raikes prepared plans, and he estimated the cost of the three sections at 2,000*l*., 1,400*l*., and 1,800*l*. respectively. It would also be necessary to provide for furniture, heating, salary of curator, wages of caretaker, &c. The arrangements were approved by the provisional committee. Afterwards the sub-committee discovered that a far more eligible site than the one proposed was to be sold at a very moderate price. This is the historic property known as the Prebendal. It consists of a large, substantially-built house, and about four acres of pleasure grounds, with fine old timber, which would be a most important addition to the museum, opening up all kinds of possibilities, and in any case they could not fail to be an immense boon to all residents and visitors. The price asked for this property is 5,000*l*. This is upwards of 900*l*. less than would be required to complete the other plan, and in the end means four acres in the best position situation, instead of a circumscribed area in a less perfect situation, of 90 ft. by 30. A portion of this outlay could be recouped by selling or letting certain outlying plots for building and by letting some of the outbuildings. The offer extends only for six months, so, to prevent the opportunity being lost, it is imperative that whatever is done in the matter be done at once.—*Herts Advertiser.*

SHROPSHIRE NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—The annual general meeting of this society was held at Shrewsbury on the 28th ult., Mr. A. P. Heywood Lonsdale being in the chair. The annual report, which was read by the Secretary (Mr. F. Goyne), stated that the Council had during the year devoted attention to the preservation of the interesting discoveries which hade been made in the crypt of old St. Chad's Church, Shrewsbury, and Lord Barnard had shown his interest in the work of the society by offering to give every facility for making further researches on the site of the old Roman city of Uriconium, near Shrewsbury. This offer was at present the subject of communication between the Council and the Society of Antiquaries of London. The financial condition of the society was reported to be unsatisfactory, and that for this reason and others it was not possible at present to proceed with this work. The report was adopted.

LEGAL.

CASE UNDER THE METROPOLITAN BUILDING ACT:

NEGLECTING TO GIVE NOTICE.

AT Woolwich Police Court on the 27th ultimo, before Mr. Marsham, the presiding magistrate, William Marrable, of 27, Park-road, Plumstead, was summoned by Mr. Thomas Batterbury, District Surveyor of Plumstead and Eltham, for not having given him notice previous to the erection of a small one story building in Brewery-road, Plumstead, as required by the Metropolitan Building Act, section 38. The defendant was fined 1*l*., and the magistrate allowed 1*l*. 3s. costs.

COMPETITIONS, CONTRACTS, AND PUBLIC APPOINTMENTS.

COMPETITIONS.

Nature of Work.	By whom Advertised.	Premiums.	Designs to be delivered.
Designs for Decorating Town Hall	Huddersfield T. C.	.....	Mar. 1
*Sanitary Milk Can	Sanitary Inspec. Assoc.	10*l.* 10*s.*	do.

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
*Works, Materials, &c.	Westminster Vestry	G. R. W. Wheeler	Feb. 7
*Fire Appliances	Leyton Local Board	W. Dawson	do.
*York Paving Stone, &c. &c.	Rotherhithe Vestry	*Official*	do.
*Road Works	Lewisham Bd. of Wks	do.	do.
Granite Road Metal, &c.	Poplar Union	do.	do.
Stores	South Indian Ry. Co.	do.	do.
Iron and Steel Work (six months)	Manchester Ship Canal	do.	do.
Brick Sewer	Bolton Town Council	do.	Feb. 8
Police Offices	Aberdeen Town Coun.	do.	do.
*Articles and Materials	St. Mary (Battersea) Vestry	do.	do.
Dwelling-house, &c. Ebbw Vale	Tabernacle Congregational Church	R. Watkins	do.
Parsonage House, Middleton, Westmoreland	Rev. Ll. Davies	J. F. Curwen	do.
Sewerage Works	Whitehaven U.R.S.A.	Pickering & Crompton	do.
Stoneware Pipe Sewer	Plumstead Bd. of Wks	W. G. Forder	do.
Restoration of Chapel, Cog-lane, Burnley	Myrtle Bank Chapel Trustees	.....	do.
Vestry, &c. Christ Church, Maryport	.....	C. Eaglesfield	Feb. 9
Store Buildings	Rawtenstall Industrial Co-op Soc.	.....	do.
Gasholder..	Horsham Gas Co.	E. D. Sapey	do.
Portland Cement, Valletta, Malta	Director of Contracts	*Official*	do.
Labourers' Cottages	Cork Union	do.	do.
Additions, &c. to Cottages, Eton Wick	Eton Local Board	do.	do.
*Underground Urinal	Lambeth Vestry	do.	do.
Road Works, Hereford	Dore Highway Board	do.	Feb. 10
Cottage, &c. Kilcoleman	Mallow Union	do.	do.
Ragstone Walls and Piers, Cemetery	Maidstone Burial Bd.	Tootell & Sons	do.
Warehouse, Bradford, Yorks	.....	T. C. Hope	do.
Additions, &c. to Llandyry House, near Kidwelly	T. Arnold	.....	do.
Granite Kerb, &c. (large contract), Westminster	.....	Rawlence & Squarey	Feb. 11
Road Metal	Renfrew Road Trust	Jas. Lang	do.
School Buildings, Preston	Deaf and Dumb School Committee	Sames & Green	do.
Additions, &c. to Independent Church, Tonypandy, S. Wales	Rev. E. Richards	O. M. Roberts	do.
Thirteen Houses, Tylorstown, S. Wales	S. Cym Jones	.....	do.
Two Dwelling-houses, Gordon-street, Workington	.....	W. G. Scott	do.
Water Supply, Ballynoc, Ireland	Fermoy Union	*Official*	do.
Parochial House, Kilshannig, Ireland	Rev. B. Shinnick	.....	Feb. 12
*Heating and Hot-water Supplies, &c.	Coventry Corp.	Spalding & Cross	Feb. 13
Granite Kerbing, &c.	Beckenham Local Bd.	G. B. Carlton	do.
Wesleyan Chapel, Schools, &c. Wath-on-Dearne, Yorks	Allan Hicks	J. Wills	do.
Pile Driving, &c. Dartford	StoneCourtChalk, Land & Pier Co. Lim.	G. H. Tait	do.
Wesleyan Chapel and School, Burraton, Cornwall	J. A. Parkes	.....	do.

CONTRACTS—*Continued.*

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
Additions to House, Hayfield, Glusburn, Yorks	J. C. Horsfall	F. W. Petty	Feb. [illegible]
Paving Works, Alder-street	Atherton (Lancs) Loc. Bd.	*Official*	do.
Ironwork, &c.	Cooch Behar State Ry. Co.	do.	do.
Cast-iron Pipes, Hydrants, &c.	Bootle Corp.	do.	do.
Artisan's Dwellings, Greencastle, Belfast	John Barbour	Young & Mackenzie	Feb. [illegible]
Road Improvements	Southampton Corp.	W. B. G. Bennett	do.
Vestry, Chancel, &c. St. Illtyd's Church, Bridgend	Rev. David Davies	E. M. Bruce Vaughan	do.
*Supply of Materials	Willesden Local Board	O. Claude Robson	do.
*Public Library, Fire Station, &c.	do.	*Official*	do.
*Construction of Sewer, &c. Hackney	LondonCountyCouncil	do.	do.
Road Diversion, Nantgarw	Glamorgan C.C.	do.	do.
Four-lift Gasholder	Rochdale Corp.	do.	Feb. [illegible]
Iron Castings	Birkenhead Corp.	do.	do.
Road Materials, Flags, &c.	do.	do.	do.
Portland Cement	Southport Corp.	W. Crabtree	do.
Service Reservoir, Boreland, Burn	Kirkcudbright T.C.	J. & A. Leslie & Reid	do.
*Roadmaking Works	Fulham Vestry	W. Sykes	do.
*Iron Building	West Ham Union	F. J. Sturdy	do.
*Broken Granite, Chippings, Flints, &c.	Greenwich B. of Wks.	*Official*	do.
*Alterations at Workhouse, Hospital, Pavilions	Orsett Union	Chas. Pertwee	do.
Warehouses and Shops	Brighouse Indus. Soc. Lim.	Sharp & Waller	do.
Steel Rails, &c. (7,000 tons)	Lanarkshire and Dumbartonshire Ry. Co.	Formans & M'Call	Feb. [illegible]
Farmhouses, Cottages, &c. Aberdeen	Haddo House Estates	*Official*	Feb. [illegible]
Materials	Blackburn Corp.	J. B. McCallum	Feb. [illegible]
Supply and Laying Water Mains	Dartmouth Corp.	T. O. Veale	do.
Cast-iron Water Mains	Clun U.R.S.A.	R. L. Bamford	Feb. [illegible]
*Second Portion Parcels Office, Mount Pleasant	Com. of H. M. Works	*Official*	do.
*Sewerage Works, &c.	Dorking Local Board	J. Lemon	do.
*Alterations to Mortuary, &c. E. Hospital	Met. Asylums Board	A. & C. Harston	Feb. [illegible]
Teachers' Residence, Soldierstown, Lurgan, Ireland	Rev. J. W. Sleator	.....	Feb. [illegible]
*Two Organs	West Ham Council	Lewis Angell	Feb. [illegible]
*Works and Materials	Mortlake Highway Bd.	H. Richards	Feb. [illegible]
Clubhouse, Southend	Minima Sailing Club	E. Wright	No date
Church Roof, Stone, Glos.	Rev. C. Cripps	Waller & Son	do.
Five Houses and Shop, Ashton-under-Lyne	.....	T. George & Son	do.
Residence	Dr. Carmichael	Settle & Farmer	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.
Water Fittings, &c. Inspectors	Shrewsbury Corp.	100*l.*	Feb. [illegible]
*Clerk of Works, South Shields	Ecclesiastical Com.	3*l.* 3*s.* 0*d.* per week	Feb. [illegible]
Surveyor, &c.	Aberavon Corp.	.....	Feb. [illegible]
*Clerk (Works Department)	London C.C.	200*l.*	Feb. [illegible]
*Principal Assistant (Building Branch)	do.	250*l.*	do.
Road Surveyor	Argyll C.C.	220*l.*	Feb. [illegible]
Consulting Architect	Glamorgan C.C.	Fees depending on wk.	Feb. [illegible]
*Accountant Clerk (Boro' Engineers' Department)	West Ham Council	120*l.*	do.

Those marked with an Asterisk (*) are advertised in this number. *Competition, p.* iv. *Contracts, pp.* iv., vi., *and* viii. *Public Appointments, p.* xxii.

CAPITAL AND LABOUR.

THE EDINBURGH TOWN COUNCIL AND THE CITY CONTRACT SYSTEM.—The Cleaning and Lighting Committee of the Edinburgh Town Council, at their meeting on the 30th ult., considered the remit made to them from last Council meeting on the subject of the proposed declaration to be inserted in any city contracts to the effect that "The contractors shall pay the standard recognised rate of wages, or such wages as are generally accepted as fair in the trade." Councillor John Jamieson moved, and Councillor Scott seconded, the following motion:—"That such a recommendation, if adopted, would not materially affect the contracts and estimates of the year in the Cleaning and Lighting Department." Councillor Sloan moved as an amendment the following motion:—"Having heard the officials (the Burgh Engineer and the Inspector of Cleaning), the Cleaning and Lighting Committee are of opinion that the insertion of any declaration such as that recommended would be an unwarrantable attempt to interfere with the security of contracts by importing into them a dangerous and contentious principle; and, further, that if the recommendation of the Lord Provost's Committee were by any means approved and carried out, the result would be a material increase in the expenditure of the department, and a bar to healthy trade competition." Councillor Cranston seconded the motion, and, in doing so, called attention to the evidence given before the Labour Commission, and pointed out that the London County Council had found out their mistake in having adopted a declaration of this kind. On a division, Mr. Sloan's amendment was carried by 8 votes to 6.

MEETINGS.

FRIDAY, FEBRUARY 3.

Sanitary Institute (Lectures for Sanitary Officers).—Dr. Louis Parkes on "Water Supply, Drinking Water, Pollution of Water." 8 p.m.

Royal Institution.—Mr. Alexander Siemens on "Theory and Practice in Electrical Science." 9 p.m.

Society of Arts (Howard Lectures).—Professor W. C. Unwin on "The Development and Transmission of Power from Central Stations." IV. 8 p.m.

Institution of Mechanical Engineers.—Annual general meeting (Second Day). Mr. William Matthews will give a description of the Pumping Engines and Water-softening Machinery at the Southampton Water Works. 7.30 p.m.

SUNDAY, FEBRUARY 5.

Sunday Lecture Society.—Sir James Crichton Browne on "Handicraft." 4 p.m.

MONDAY, FEBRUARY 6.

Royal Academy of Arts.—Professor Aitchison, A.R.A., will deliver his Fifth Lecture for Session 1892-93: Subject, "What is Architecture, and how can it be Advanced?" 8 p.m.

Surveyors' Institution.—Further discussion on (1) Mr. P. D. Tuckett's paper entitled "A Short Explanation of the Proposed Bimetallism as affecting British Interests"; (2), Mr. A. Goddard's paper on "The Currency Question and Land." 8 p.m.

Society of Engineers.—Inaugural Address by the President, Mr. W. A. M. Valon. 7.30 p.m.

Society of Arts (Cantor Lectures).—Professor J. A. Fleming, M.A., F.R.S., on "The Practical Measurement of Alternating Electrical Currents." II. 8 p.m.

London Institution.—Mr. J. J. Harris Teall, M.A., F.R.S., on "The Natural History of Silica." 5 p.m.

Clerks of Works' Association (Carpenters' Hall).—Monthly Meeting. 8 p.m.

Liverpool Architectural Society.—Mr. John Holden on "Materials and Construction." 6.30 p.m.

Leeds and Yorkshire Architectural Society.—Mr. J. W. Morkill, M.A., on "The Knight Templars in England, with special reference to their possessions in Leeds and district." 7.30 p.m.

TUESDAY, FEBRUARY 7.

Institution of Civil Engineers.—Further discussion on (1) Mr. H. F. Collins' paper on "Smelting Processes for the Extraction of Silver and Gold from their Ores"; (2), Mr. J. W. Malcolmson's paper on "The Erection of Silver-Lead Smelting Works in Mexico." 8 p.m.

British Museum.—Miss Emily Penrose on "The Daily Life of the Athenians." II. 2.30 p.m.

Institute of Builders.—Ordinary General Meeting. 3.30 p.m.

Society of Arts (Applied Art Section).—Mr. Wilton P. Rix on "Pottery Glazes: their Classification and Decorative Value in Ceramic Design." 8 p.m.

Sanitary Institute (Lectures for Sanitary Officers).—Mr. H. Law on "Principles of Calculating Areas, Cubic Space, &c.; Interpretation of Plans and Sections to Scale." 8 p.m.

Society of Biblical Archæology.—Rev. A. Löwy on "A Babylonian Brick." 8 p.m.

Glasgow Architectural Association.—Mr. W. Gothic on "Glass Work." 8 p.m.

WEDNESDAY, FEBRUARY 8.

Sanitary Institute.—Dr. Poore on "Light, Air, and Fog." 8 p.m.

Society of Arts.—Paper by Professor W. Noel Hartley, F.R.S., entitled "Some Points in the Chemical Technology of Oil Boiling, with an Account of a New Process for Preparing Drying Oils, for Decorators' and Artists' Use." 8 p.m.

St. Paul's Ecclesiological Society.—The Rev. James Cooper, of Aberdeen, on "The Ecclesiology of Scotland." 7.30 p.m.

Edinburgh Architectural Association.—Mr. A. N. Paterson, M.A., on "Colour as a Means of Architectural Expression." 8 p.m.

Liverpool Engineering Society.—Mr. James H. Lynde on "Automatic Sprinklers." 8 p.m.

THURSDAY, FEBRUARY 9.

Royal Academy of Arts.—Professor Aitchison, A.R.A., will deliver his Sixth Lecture for Session 1892-93: Subject, "What is Architecture, and how can it be Advanced?" 8 p.m.

Society for the Encouragement of the Fine Arts.—Mr. H. Beaumont on "Gothic Windows and their Designs." 8 p.m.

Institution of Electrical Engineers.—(1) Professor Fleming's reply to the discussion on his paper on "Alternate Current Transformers"; (2), Mr. W. M. Mordey on "Testing Alternators." 8 p.m.

Society of Antiquaries.—8.30 p.m.

FRIDAY, FEBRUARY 10.

Architectural Association.—Mr. C. J. Tait on "The Value of Criticism." 7.30 p.m.

Institution of Civil Engineers (Students' Meeting).—Mr. H. Calder Löbnitz on "Long Shoot Dredgers—their design and mode of working." 7.30 p.m.

Sanitary Institute (Lectures for Sanitary Officers).—Mr. W. C. Tyndale on "House Drainage." 8 p.m.

Society of Arts (Howard Lectures).—Professor W. C. Unwin on "The Development and Transmission of Power from Central Stations." V. 8 p.m.

SATURDAY, FEBRUARY 11.

Architectural Association.—Visit to the Church of St. Bartholomew the Great, West Smithfield, by permission of Mr. Aston Webb. 3 p.m.

Sanitary Inspectors' Association.—Dinner at the "Criterion," Piccadilly. 6 p.m.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

19,813.—CEMENT MORTAR: *O. Böklen.*—This specification relates to an improved process for making cement, or cement mortar, characterised by the energetic mechanical treatment of the cement mortar by subjecting it to alternate strong pressure with a simultaneous lateral displacement of the mortar particles, which may be done by means of rollers travelling backwards and forwards, roller mills, pug mills, stamps, &c., and further by means of a cement mortar holder, having a jagged, ridged, or wavy-shaped bottom, as well as by means of hand hammers.

20,831.—BRICKS: *Von Hünersdorff.*—This invention has for its object to provide bricks or blocks for building purposes, capable of forming a better joint with one another, in the structures of which they form a part, whereby such structures are prevented from becoming distorted, or from "settling" in process of erection, and uniformity in their joining lines is ensured. These bricks are formed with projecting bands or ribs on two or more of their sides of thickness corresponding with the distance which it is desired to space the bricks of a structure apart from one another, such ribs being formed either longitudinally or transversely in respect of the length of the brick, according as it is to be placed with its length parallel to the front of the wall or structure, or at right angles.

20,140.—WALL COMPOSITION: *H. H. Lake.*—This specification refers to a new composition for covering walls, produced by adding glue to waste sulphite liquor, allowing it to stand until all resulting changes have been completed, and then adding sand, ground marble, or pulverised slate, wood fibre, and sulphate of lime.

20,414.—ARTIFICIAL STONE: *P. A. Moreau.*—This invention relates to the manufacture of variegated or veined artificial stone, and imitations of natural marble. The inventor uses any suitable cement, plasters, or other composition capable of being mixed into a semi-liquid, or pasty form, and poured into a mould, and afterwards of setting sufficiently hard for the purpose required. As many different portions of such composition are prepared as may be required, and each of such portions is coloured with any suitable colouring material, so as to have a series of portions of composition coloured for each shade of colour which it is proposed to use. Such compositions are then intermingled, so as to imitate as nearly as may be the desired colours and veining of the natural stones to be imitated. The mass of variegated composition thus produced must be allowed to set, and a block or other article is thus formed, veined in different colours, not merely on the surface, but throughout the interior.

17,675.—WINDOW SASH FRAMES: *R. F. Dampier.*—This patent relates to improvements in the construction and arrangement of window sashes and frames, and has for its object so to construct and arrange such sashes and frames as to economise their cost by reducing the number of working parts and at the same time to obtain greater efficiency in the means of ventilation. In lieu of sash weights the inventor has a cord at each side of the window passing over axle pulleys which are made use of instead of the ordinary sash cord pulleys. These cords are attached at one end to the top sash and at the other to the bottom sash in such manner that when the one sash is raised the other is lowered and *vice versa*. Hence, a double current is ensured when the window is opened, no matter whether it is the top sash or the lower one which is manipulated. To avoid creating a draft underneath the bottom sash and still to maintain a through circulation when it is desired to open the window simply for ventilation purposes, a somewhat deep inside lining is formed upon the window sill so as to allow of the bottom sash being raised say a couple of inches before any actual opening is formed at the bottom of the window. The air inlet will then be between the meeting rails.

18,145.—PLASTER: *T. Jones.*—This patent refers to what is claimed as an improved plaster for building purposes, and consists in a process for the production of plaster by mixing together shale or clay (containing or having added thereto potash), which has been treated with dilute sulphuric acid, and oven calcined gypsum in certain stated proportions.

NEW APPLICATIONS FOR LETTERS PATENT.

January 16.—910, H. Shelmerdine and R. Holt. Connexions for Sanitary Pipes.—929, A. Travis, Fastening and Sealing Device for Doors.—953, J. White, Warming and Ventilating Rooms, &c.—959, F. Ryan, Roofing Slates.

January 17.—999, W. Petty, Combined Automatic Door-stop and Catch.—1,032, S. Gedge, Sash Holders.—1,058, G. Thiell, Controlling the Draught in Chimneys.—1,067, J. Sherson and H. Crisp, Tops or Guards of Chimneys and Ventilating Shafts.—1,073, A. Ford, Gully Trap.—1,075, H. Buchan and W. Peters, Preventing Water in Pipes from Freezing.

January 18.—1,100, J. Blackburn, Raising, Lowering, Sustaining, Balancing, and Securing of Sashes for Windows, Doors, &c.—1,103, J. Garnett and T. Wilson, Cramping Window Frames, Doors, &c.—1,114, A. Kent, Sash Fastener.—1,128, W. Thompson. Process and Machine for Producing Ornamented Wooden Beadings, Mouldings, Veneers, &c.—1,150, C. Atlee, Window Fasteners.—1,153, F. Carel and W. Davidson, Revolving Fire Grate.—1,154, C. Zimmermann, Cutter for Woodwork.

January 19.—1,162, M. Syer, Connexion for W.C. Traps and Pipes.—1,169, H. Wright and W. Smith, Grates of Fireplaces.—1,184, W. Coke, Self-Acting Wedge for Window Sashes, &c.—1,187, J. Lomax, Holder for Paint Brushes, &c.—1,194, J. Hamblet, jun., Roofing Tiles.—1,207, T. Ryland, Hinges.—1,221, S. Wyand and L. Schramm, Top for Smoky Chimneys, applicable also for Ventilating purposes.

January 20.—1,246, W. Edwards, Gas Lighting Appliances.—1,250, J. Pullen and W. Mann, Gully Traps.—1,252, J. Hartell, Preventing the Freezing of Water in Pipes.—1,253, A. Welsh, Plug or Stopper and Tester for Drains and Pipes.—1,266, P. G. Allday, Door Chain.—1,295, C. Howatson, Door Handles.

January 21.—1,315, B. Drake and J. Gorham, Preventing Freezing of Water Pipes.—1,351, W. Melville, Pipe Joints.—1,357, F. Wilkins, Set Squares.—1,379, C. Pickles, Stoves or Ranges.—1,381, G. Josephy, Air Moistening and Ventilating Apparatus.—1,383, T. Williams, Door Closer.

PROVISIONAL SPECIFICATIONS ACCEPTED.

20,380, J. Weeks, Joints for "Sewer," Drains, Gas, Water, and other Pipes.—21,960, J. Crosthwaite, Rain Water Pipes, &c.—22,580, G. Capewell, Nail and Tack Driver and Puller.—22,707, J. Craig and R. Highet, Syphon Discharge Cisterns.—22,790, J. Marshall and others, Cranes.—22,841, J. Goodman and F. Stone, Tops or Guard, of Chimney and Ventilating Shafts.—22,861, J. Holden, Damp Proof Bricks.—22,892, J. Dean, Water Closets.—22,908, J. Horrocks, Cisterns for Water Closets.—23,026, J. Clarke, Stays for Fanlights and Skylights, &c.—23,065, W. Lane and A. Abbott, Syphon Flushing Cisterns.—23,142, J. Porter, Sash Fasteners.—21,175, F. McIlvenna and others, Sash Frames, Ventilators, &c.—23,181, J. Hamblett, Paving Bricks.—23,192, J. Blakesley, Fireproof Floors, Roofs, Girders, Joists, &c.—23,376, J. Ablett, Fireproof Floors.—23,413, J. Shanks, Water Closets and Water Supply Apparatus for same.—23,416, G. Maxwell, Concrete Construction.—23,439, P. Halliwell and J. Hampson, Drawing Smoke from Chimneys, also for Ventilating Chimneys.—23,444, H. German, Herring-Bone Stut or Bridging.—23,445, J. Sutton, Chimney Cowls.—23,474, S. Grüber, Lattice for Use in Building Arched Roofs and other Constructions.—23,564, H. Joly, Lattice Truss or Girder for use in Building.—23,638, E. & G. Collier, Roofing Tiles with a Rough Surface.—23,771, A. Browne, Bricks, Blocks, Ornaments, Paving, Paving Tiles, Artificial Stone and the Like for Building Purposes.—23,871, A. Rendle, Glazed Structures.—23,982, J. Twyford, Water Closets, or Water Closet Basins.—24,044, D. Gill, Method of Isolating Rooms in Private Houses and other Buildings.—1893: 12, J. Shanks, Domestic Water Supply Apparatus.—157, S. Williams and G. Wood, Flooring in Iron and Steel.—160, W. Brierley, Chimney Tops.—265, F. Martin, Chimney-Pots.—425, G. Burge, Cement Kilns.—484, J. Brown and T. Curry, Making Bricks, Blocks, or Stones for Building Purposes, without Burning.—616, T. Houghton, Sashes and Frames.—637, W. Crook, Brick and Tile Making Machines.

COMPLETE SPECIFICATIONS ACCEPTED.

(Open to Opposition for Two Months.)

4,791, T. Bradbear, Closet Fittings.—5,053, A. Ransome, Band-Sawing Machines.—5,291, W. Morton, Ornamental Materials for Decorating Walls, &c.—14,226, G. Martin, Glazing Roofs and Skylights.—16,752, J. Conley and J. Wolfe, Brick Kilns.—18,178, J. Wade and Others, Decorating Tiles.—21,932, J. Stutley, Composition Paint.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

JANUARY 23.—By *T. Woods:* 100 and 102, High-st., Hounslow, and Factory, f. in 1 Lot, 1,440*l.*

JANUARY 24.—By *E. & H. Lumley:* 7, St. James's-st., St. James's, f., area 2,000 ft., 12,000*l.*—By *Fairbrother, Ellis, Clark, & Co.:* Nos. 25, 26 and 87, Cornhill, f., area 1,950 ft., 90,000*l.*; No. 24, Cornhill, f., area 550 ft., 23,500*l.*; f.g.r. of 35*l.*, Camberwell-rd., Camberwell, with reversion in 11 yrs., 1,505*l.*; 1 to 23, Dame-st., Islington, u.t. 43 yrs., g.r. 69*l.*, r. 856*l.*, 6,830*l.*; 39 to 52, Dame-st., u.t. 43 yrs., g.r. 31*l.* 10s., r. 577*l.*, 4,470*l.*; 4 to 10 (even) Linton-st., u.t. 43 yrs., g.r. 9*l.*, r. 180*l.*, 1,405*l.*; 1, Linton-st., u.t. 43 yrs., g.r. 2*l.* 5s., r. 34*l.*; and an i.g.r. of 50*l.*, u.t. 43 yrs., g.r. 2*l.* 5s., 1,040*l.*; the letting of an area of 2,500 ft., Shaftesbury-av., u.t. 80 yrs., let at 270*l.* per annum.

JANUARY 25.—By *D. Young:* 168, Lancaster-rd., Notting Hill, u.t. 71 yrs., g.r. 10*l.*, r. 50*l.*, 406*l.*; 3, Nelson-sq., Blackfriars, u.t. 11 yrs., g.r. 6*l.*, r. 48*l.*, 105*l.*; 29, Lorrimore-sq., Walworth, u.t. 52 yrs., g.r. 6*l.*, r. 40*l.*, 350*l.*—By *Carey and Lewis:* Six plots of f. land, Finchley-rd., Hampstead, 710*l.*

JANUARY 26.—By *D. Watney & Sons:* l.g.r. of 112*l.*, Vauxhall Bridge-rd., u.t. 31 yrs., g.r. 32*l.*, 1,270*l.*—By *J. A. Trythall:* 42 to 48, Farnley-rd., Norwood, f., 2,505*l.*—By *H. Oughton & Son:* 95, Campden Hill-rd., Notting Hill, f.r. 65*l.*, 1,120*l.*; 239, Cornwall-rd., u.t. 70 yrs., g.r. 9*l.*, r. 40*l.*, 320*l.*; 51 and 53, Southgate-rd., Hackney, u.t. 23 yrs., g.r. 12s., r. 105*l.*, 830*l.*; 110, Downham-rd., u.t. 23 yrs., g.r. 6s., r. 48*l.*, 355*l.*—By *Newbon & Co.:* l.g.r. of 36*l.*, Elmore-st., Islington, u.t. 60 yrs., g.r. 5*l.*, 630*l.*; 181 and 187, King's-rd., Camden Town, u.t. 49 yrs., g.r. 16*l.*, r. 110*l.*, 935*l.*; 35, Romilly-rd., Holloway, u.t. 77 yrs., g.r. 5*l.*, r. 34*l.*, 355*l.*; 40, 42, and 44, Fonthill-rd., u.t. 72 yrs., g.r. 21*l.*, r. 110*l.*, 710*l.*; 67, Moray-rd., u.t. 73 yrs., g.r. 6*l.* 6s., r. 34*l.*, 320*l.*; 49, Hanley-rd., Hornsey, f., r. 40*l.*, 590*l.*—By *C. C. and T. Moore:* 64 to 72 (even), Brabazon-st., Poplar, f., 925*l.*; 18, Addington-rd., Bow, u.t. 54 yrs., g.r. 4*l.* 10s., 410*l.*; 123, New-rd., Whitechapel, f., 800*l.*; 23 and 25, West Arbour-st., Commercial-rd., E., u.t. 72 yrs., g.r. 8*l.*, r. 51*l.*, 130*l.*

JANUARY 27.—By *A. Watson:* F.g.r. of 55*l.*, Laurence Pountney-lane, City, with reversion in 22 yrs., 12,650*l.*—By *Robert Reid:* 21, Sidmouth-st., Gray's Inn-rd., f., 655*l.*; 100, Waterloo-rd, Lambeth, u.t. 29 yrs., no g.r., r. 65*l.*; 860*l.*; 102, Waterloo-rd., u.t. 29 yrs., no g.r., r. 74*l.*, 905*l.*, 92, Waterloo-rd., u.t. 29 yrs., no g.r., sold privately; 3 and 4, North-cresent, Tottenham Court-road, and two houses in Airdrie-pl., u.t. 9 yrs., g.r. 20*l.* 10s., r. 210*l.*, 1,005*l.*—By *Jones, Lang, & Co.:* "York Villa," York-rd., Norwood, f., 1,400*l.*

[*Contractions used in these Lists.*—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground rent; i.g.r. for improved ground-rent; g.r. for ground rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent yd. for yard, &c.]

PRICES CURRENT OF MATERIALS.

TIMBER.		
Greenheart, B.G. ton	9/0/0	0/0/0
Teak, E.I. .. load	9/10/0	15/0/0
Sequoia, U.S.ft.cu.	2/3	2/6
Ash, Canada load	2/10/0	4/0/0
Birch, do.	3/5/0	4/10/0
Elm, do.	3/10/0	4/15/0
Fir, Dantsic, &c.	1/10/0	3/10/0
Oak, do.	3/0/0	5/5/0
Canada	5/10/0	7/0/0
Pine, Canada red	2/10/0	3/10/0
Do. Yellow	2/10/0	5/0/0
Lath, D'ntsic, fath	5/0/0	6/0/0
St. Petersburg.	5/0/0	7/0/0
Deals, Finland 2nd & 1st std 100	7/10/0	10/0/0
Do. 4th & 3rd ..	7/10/0	8/0/0
Do. Riga	6/10/0	8/0/0
St. Petersburg. 1st yellow	10/10/0	14/10/0
Do. 2nd yellow..	8/10/0	9/10/0
Do. white	7/10/0	9/10/0
Swedish	7/10/0	16/0/0
White Sea	8/10/0	17/0/0
Canada, Pine 1st	21/0/0	27/10/0
Do. do. 2nd	15/0/0	17/0/0
Do. do. 3rd &c.	7/10/0	10/0/0
Do. Spruce, 1st	8/10/0	11/0/0
Do. do. 3rd & 2nd	6/10/0	8/0/0
New Brunswick	6/10/0	7/10/0
Battens, all kinds	3/10/0	15/10/0
Flooring boards, sq., 1 in. prep. 1st	0/8/0	0/14/0
Do. 2nd	0/7/0	0/10/0
Other qualities—	0/3/6	0/7/6
Cedar, Cuba ..ft.	/3½	/4½
Honduras, ..&c	/3½	/4½
Mahogany, Cuba	/4½	/6½
St. Domingo, cargo av.	/4	2/0
Mexican do. do.	/4	/5
Tobasco do. do.	/4½	/7
Honduras do. ..	/5	/6½
Box, Turkey ton	4/0/0	13/0/0
Rose, Rio	10/0/0	20/0/0
Bahia	9/0/0	18/0/0
Satin, St. Domingo ..ft.	0/0/6	0/1/3
Porto Rico	0/0/7	0/1/6

TIMBER (*continued*).		
Walnut, Italian ..	0/0/3½	0/0/7
METALS.		
Iron—Pig, in Scotland ..ton	2/4/9	0/0/0
Bar, Welsh, in London	5/17/6	6/0/0
Do. do. at works in Wales	5/7/6	5/10/0
Do. Staffordshire, in London	6/0/0	6/10/0
COPPER—British, cake and ingot	47/15/0	48/5/0
Best selected ..	49/0/0	49/10/0
Sheets, strong ..	58/0/0	0/0/0
Chili, bars	45/2/6	45/10/0
YELLOWMETALlb	0/0/5½	0/0/5¾
LEAD—Pig, Spanish..ton	9/15/0	9/16/3
English com. brands	9/17/6	10/0/0
Sheet, English, 6 lbs. per sq. ft. and upwards	11/5/0	0/0/0
Pipe	11/15/0	0/0/0
ZINC—English sheet..ton	22/0/0	0/0/0
Vieille Montagne	22/10/0	0/0/0
TIN—Straits	92/5/0	92/15/0
Australian	92/15/0	93/5/0
English Ingots..	96/0/0	96/10/0
Banca	93/10/0	94/0/0
Billiton	93/5/0	93/10/0
OILS.		
Linseed ..ton	19/7/6	19/10/0
Cocoanut, Cochin	27/10/0	0/0/0
Do. Ceylon	26/10/0	0/0/0
Palm, Lagos	27/10/0	0/0/0
Rapeseed, English pale	25/10/0	26/0/0
Do. brown	24/0/0	0/0/0
Cottonseed ref.	22/0/0	23/0/0
Oleine	20/10/0	21/0/0
Lubricating, U.S.	4/0/0	5/0/0
Do. refined	5/10/0	12/0/0
TAR—Stockholm barrel	0/17/6	0/18/6
Archangel	0/12/6	0/0/0

TENDERS.

[Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than 12 noon on Thursdays.*]

ASTLEY-ABBOTS (Salop).—For alterations to Canton House, Astley-Abbots, exclusive of heating, for Mr. Alfred P. Welch. Mr. Wm. Lunn, architect, Great Malvern:—

Kendrick	£2,818	H. Lovatt	£2,432
Treasure & Son	2,810	W. Bate*	2,306
H. Smith & Son	2,499	R. Thompson	2,195

* Accepted.

Stabling and Lodges.

Kendrick	£1,069	Head & Son	£918
R. Thompson	1,025	Smith & Son	885
H. Lovatt	963	W. Bate*	790

* Accepted.

BRISTOL.—For the St. George Technical School. Mr. F. Bligh Bond, architect, Liverpool Chambers, Corn-street, Bristol. Quantities by Mr. W. L. Bernard, St. Stephen's Chambers, Bristol:—

H. A. Forse	£12,524 0 0	Bale & Westlake	£11,045 0 0
J. Perkins	12,130 0 0	Edwin Clarke	11,040 0 0
G. Humphreys	11,740 0 0	R. Wilkins & Son	10,980 0 0
Stephens, Bastow & Co.	11,499 0 0	E. Walters	10,960 0 0
Hatherly & Carr	11,497 0 0	J. E. Davis	10,950 0 0
S. W. Williams	11,431 13 10	H. J. Rossiter	10,891 0 0
G. H. Wilkins	11,420 0 0	J. Perrott	10,858 0 0
Cowlin & Son	11,375 0 0	C. A. Hayes*	10,773 0 0
W. Brock & Son	11,300 0 0	A. J. Beaven	10,750 0 0
W. Church	11,188 0 0	Love & Waite	10,564 0 0
T. H. Brown	11,187 12 0	F. Martin	10,500 16 4

* Accepted subject to modification.

BROMLEY (Kent).—For the erection of three cottages for the Bromley Co-opertive Society. No quantities:—

D. Payne	£627	F. P. Duthoit	£618
W. A. Grubb	625		

CARDIFF.—For fireproof floor, &c., at new warehouse, Atlantic Wharf. Messrs. Veall & Sant, architects, Cardiff:—

Fireproof Floor.

Dawnay (accepted)	£860 0 0

Kiln Floor Joists.

Dawnay (accepted)	66 10 0

Steel Joists to Carry Upper Floors.

G. J. Beetlestone	250 0 0
Wales and West of England Girder Company	243 15 0
Dawnay (accepted)	240 0 0

CORNWALL.—Accepted or Inrants' room, addition to building in course of erection at Whitemoor, for the St. Stephen's in Branwell School Board. Mr. Sampson Hill, architect and surveyor, Redruth:—

Walters & Gilbert	£240 0 0

ILLOGAN (Cornwall).—Accepted for addition to school at Barn coose, for the Illogan School Board. Mr. Sampson Hill, architect and surveyor. Redruth:—

Masonry, &c.—W. Burnett	£270 0 0
Carpentry.—E. J. Stoneman	£159 0 0

ISFIELD (Sussex).—Accepted for restoration and additions work to the tower of St. Margaret's Church. Mr. John Rawlinson, architect, 65, Chancery-lane, London:—

Mason and Smith.—C. F. Bridgman, Lewes	£398 0 0
Carpenter, Plumber, Painter, and Glazier.—G. Bean, Isfield	258 0 0

LINCOLN.—For erecting a house in Yarborough-road, for Mr. A. T. Mays. Mr. J. H. Cooper, architect, Lincoln. Quantities supplied by the architect:—

W. Wright & Sons	£687 0	J. W. Harrison	£579 0
Lansdown & Son	660 0	S. & R. Horton*	559 14
H. S. & W. Close	630 0	* Accepted.	

[All of Lincoln.]

LONDON.—For the construction of a 12-in. stoneware pipe sewer, Colebrook-row and Halton-road (about 1,150 yards), for the Vestry of St. Mary, Islington. Mr. J. Patten Barber, Surveyor, Vestry Hall, Upper-street, N.:—

E. Parry	£796 16 8	T. Williamson	£465 5 3
F. A. Jackson & Co.	616 15 5	Thos. Adams	445 11 8
Wilkinson Bros.	589 0 4	C. W. Killingback & Co., Camden Town*	439 3 3
Wm. Walker	474 16 5		

* Accepted.

LONDON.—For the making of carriage-way, Gladsmuir-road, Upper Holloway, for the Vestry of St. Mary, Islington. Mr. J. Patten Barber, Surveyor, Vestry Hall, Upper Street, N.:—

Fred. French	£445 0	William Walker	£354 13
F. A. Jackson & Co.	417 0	T. Williamson, Hornsey*	339 15
Thos. Adams	378 0	* Accepted.	

LONDON.—For alterations and additions to "The Ship," No. 116, Wardour-street, W., for Mr. Henry Cole. Mr. Robert Henry Kerr, architect. Quantities by Mr. John Windsor:—

Bywaters & Sons	£2,382	Wilkinson	£2,154
Turner, McKay & Ashpole	2,340	Manley & Son*	2,152
Shiers	2,314	Lea Bros.	2,075
Yardley & Son	2,159		

* Accepted subject to modifications.

LONDON.—Accepted for residential mansions, 37, Hyde Park-gate, S.W. Messrs. R. C. Gleed and R. L. Curtis & Sons, surveyors.

Perry & Co. £7,600 0 0

LONDON.—Accepted for residential mansions, Grove End-road, St. John's Wood, N.W. Messrs. R. C. Gleed and R. L. Curtis & Sons, surveyors.

Perry & Co. £23,131 0 0

LONDON.—For alterations and repairs to business premises, No. 252, Euston-road, N.W. Mr. Thomas Durrans, architect, 44, Upper Baker-street, N.W.:—

J. Stevens	£1,187	J. Edgar	£916
Myring & Co.	1,180	J. Carmichael	895
Dearing & Son	995	H. C. Clifton (accepted)	893
W. Thomas	920		

LONDON.—For works necessary in underpinning the east-end of All Saints' Church, Blenheim Grove, Peckham. Messrs. Inskipp and Mackenzie, architects, 5, Bedford-row, W.C.:—

Ansell	£291	Kirk & Randall	£238
Colls & Sons	285	Parker	230
W. Downs	254	Brown, Son and Blomfield	220
Watson	248		

LONDON.—For the supply of £500 worth of wrought-iron hurdles for use in parks and open spaces under the control of the London County Council:—

	Hurdles.		Hurdles.
W. Thorpe	330 !	J. Priest & Son, Limited	1,820
W. H. Cartwright & Co.	1,110	Hill & Smith	1,900
L. Faulkner and Sons	1,430	Bayliss, Jones, & Bayliss	1,905
E. J. Raybould & Co.	1,725	H. J. Skelton & Co.	2,000
W. Bain & Co.	1,750	Staffordshire Bolt, Nut, and Fencing Co., Ltd.*	2,020 !
M. McVey	1,791	*Accepted.	
Johnson Bros.	1,805		

LONDON.—For the erection of conveniences for men in Finsbury Park, for the London County Council. Mr. Thomas Blashill, Architect:—

E. Proctor	£980 0 !	W. Wells	£631 0
A. G. Burton	735 0	A. Wallis	623 0
Bastin & Tawney	674 10	Jackson & Co.	612 0
J. W. Dixon	647 0	W. T. Williamson	524 10
H. Faulkner, Jun.	639 0	J. Inwood*	470 0 !
		* Accepted.	

SOUTHAMPTON.—For supplying and delivering wrought-iron fencing, for the Corporation of Southampton. Mr. W. B. G. Bennett, Borough Surveyor:—

H. Tuck	£295 0 0	Hill & Smith	196 17 0
W. A. Baker & Co.	275 0 0	M. McVey	195 0 0
J. B. Noble & Co.	260 0 0	R. Foot	194 0 0
L. Faulkner & Sons	233 0 0	W. H. Robinson	193 15 6
Brettle & Needham	219 0 0	Lankester & Son	190 12 6
E. J. Raybould & Co.	209 0 0	G. Fletcher & Co.	187 7 6
E. C. & J. Keay	206 5 0	Sanby & Co.	187 7 6
Rowell & Co.	206 5 0	Johnson Bros. & Cohen	185 18 9
Rowland Bros.	200 0 0	Walker Bros.	181 5 0
Priest & Son	200 0 0	Bayliss, Jones, & Bayliss, Wolverhampton*	181 5 0
F. Shalders	200 0 0		
Economic Fencing Co.	197 15 0		

*Accepted.

[Surveyor's estimate £200 0 0.]

SOUTHAMPTON.—For new mortuary, Town Quay, for the Corporation of Southampton. Mr. W. B. G. Bennett, Borough Surveyor:—

G. B. Jordan	£295 0	Crook & Son	£194 10
Roe & Grace	212 0	J. W. Rowland & Son	179 0
W. Harvey	211 0	W. C. Mears, Southampton*	167 0
F. Osman	195 0		

*Accepted.

[Surveyor's estimate, £200.]

STANLEY (Durham).—For the erection of a police-station, for the Durham County Council. Mr. William Crozier, C.E., County Architect, Shire Hall, Durham. Quantities by Mr. J. Ezra Miller, 1, Tunstall-road, Sunderland:—

E. & J. R. Taylor	£3,000 6 0	Thos. Hunter	£2,678 15 0
Westgarth & Brown	2,913 2 3	Wm. Lodge & Son	2,572 18 6
Joseph Elliott	2,864 0 0	Gradon & Son	2,551 15 9
T. Gibson	2,806 11 7	J. Shepherd, Durham*	2,530 0 0
Jas. Storar & Son	2,759 13 6	Thomas Hilton	2,520 4 0
F. Caldcleugh	2,740 0 0	*Accepted.	
W. C. Atkinson	2,706 16 6		

SWANSEA.—For the reconstruction of sanitary arrangements at the Sailor's Home, Swansea. Mr. J. Buckley Wilson and Messrs. Glendinning Moxham, architects, Swansea:—

J. H. Geen	£294	Thomas Watkins & Co.	£280
D. Jenkins	293	J. & F. Weaver, Swansea*	255
		* Accepted.	

SWANSEA.—For additions and alterations to Temple Buildings, Swansea. Mr. J. Buckley Wilson and Messrs. Glendinning Moxham, architects, Swansea:—

D. Jenkins	£450	Thomas Watkins & Co., Swansea*	£350
H. Billings	393		
Bennett Bros.	355		

* Accepted.

SWANSEA.—For additions and alterations to residence, Coedsaeson Estate, Sketty, Swansea. Mr. J. Buckley Wilson and Messrs. Glendinning Moxham, architects, Swansea:—

D. Jenkins	£790	Thomas Watkins & Co., Swansea*	£650
Bennett Bros.	685		

* Accepted.

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W. C. H. (report sent too late; should have been sent last week).—C. S. S. (thanks; we cannot find space for the drawing).—S. H. T.—R. P. T. L (we cannot assist you, further than recommending you to consult our advertisement columns).—J. O. R. (we published the list last week).

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1892.

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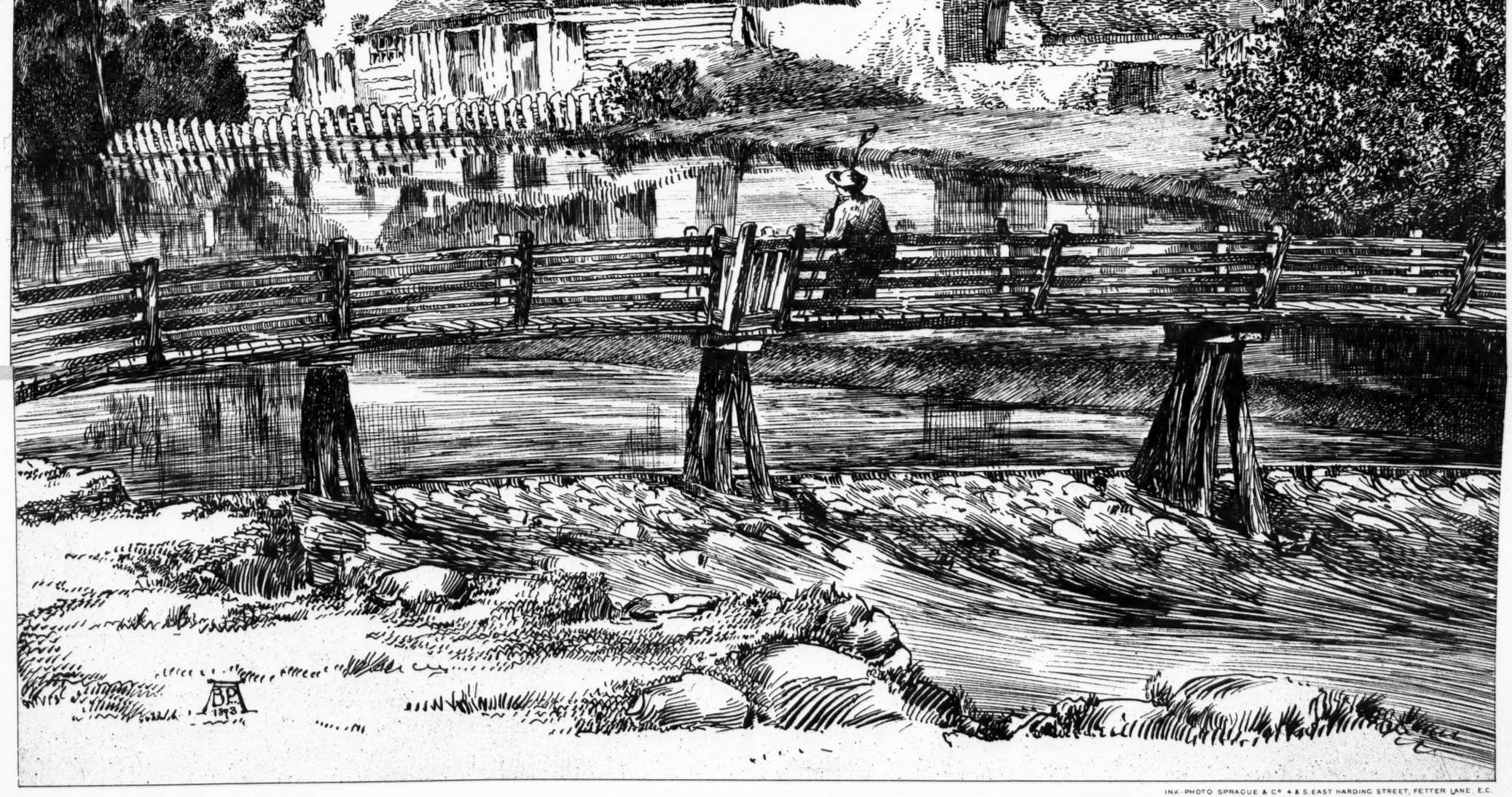


INK-PHOTO SPRAGUE & Co 4 & 5 EAST HARDING STREET, FETTER LANE, E.C.

Cathedrals of England and Wales.

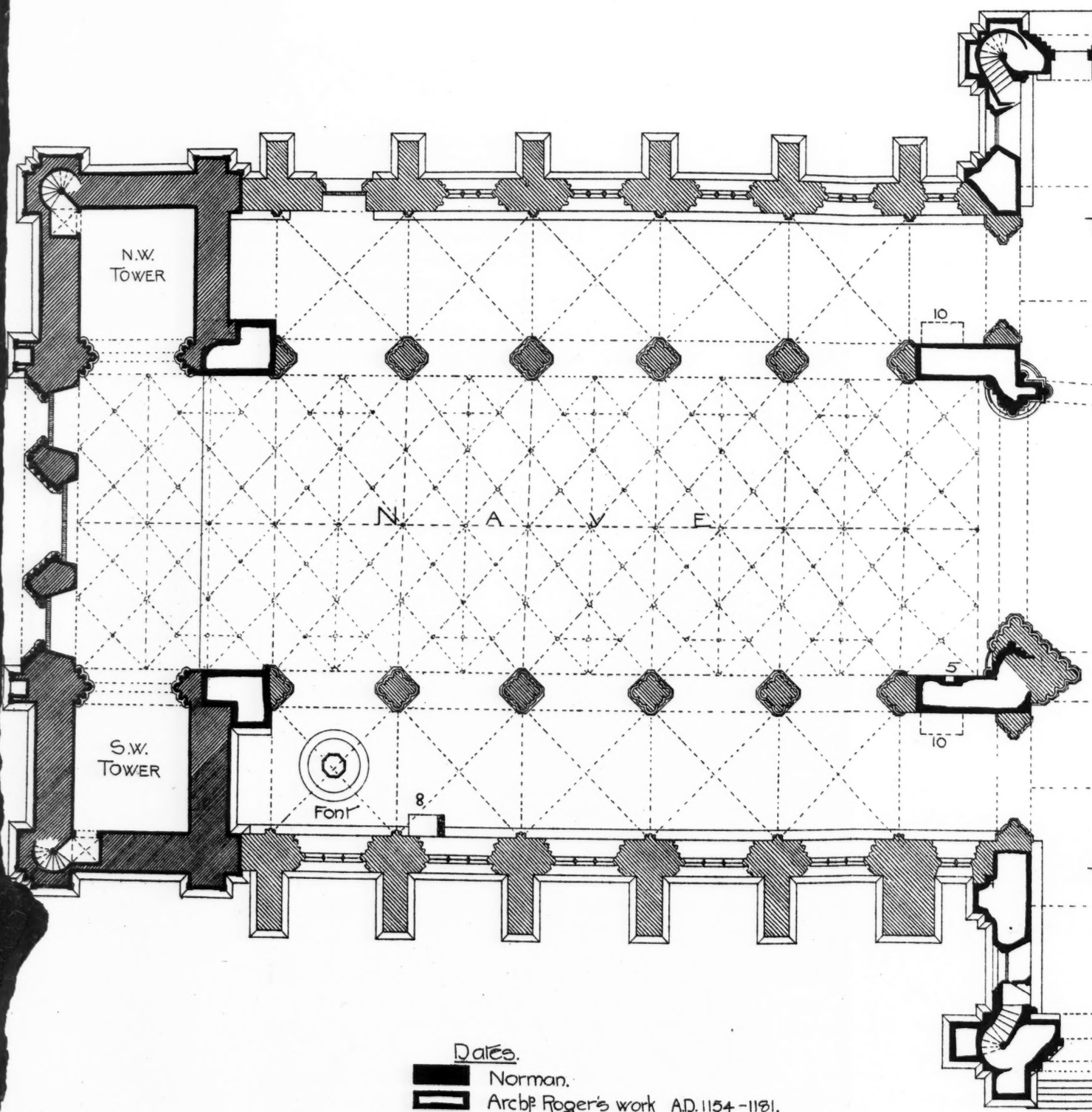
No. 27. RIPON: FROM THE SOUTH-EAST.—Drawn by Mr. Beresford Pite, A.R.I.B.A

RIPON CATHEDRAL

GROVND-PLAN.

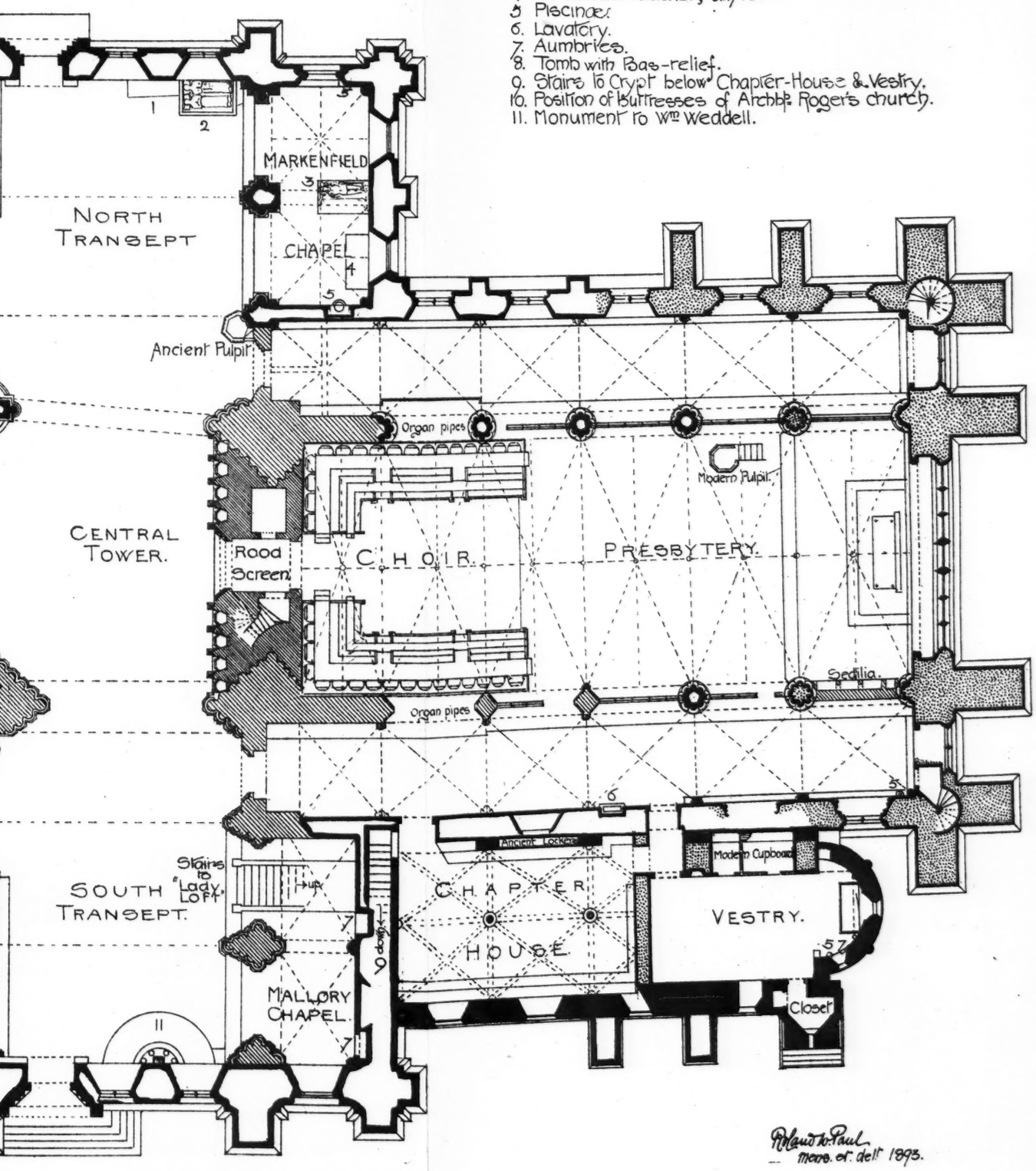
10 5 0 10 20 30 40 50 100 Feet.

Scale.



Dates.

- Norman.
- Archbp Roger's work A.D. 1154-1181.
- Early English.
- Decorated.
- Perpendicular.



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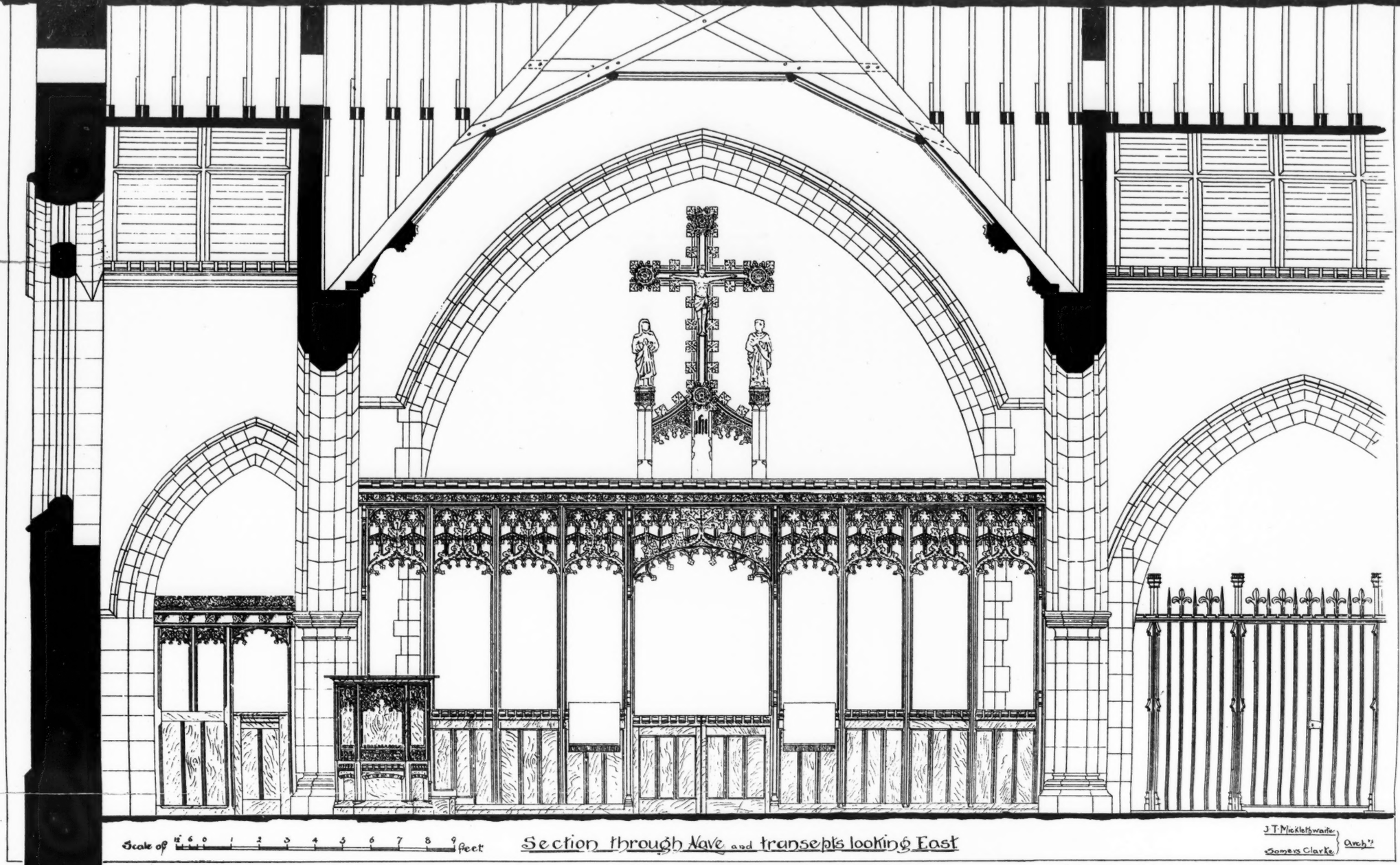

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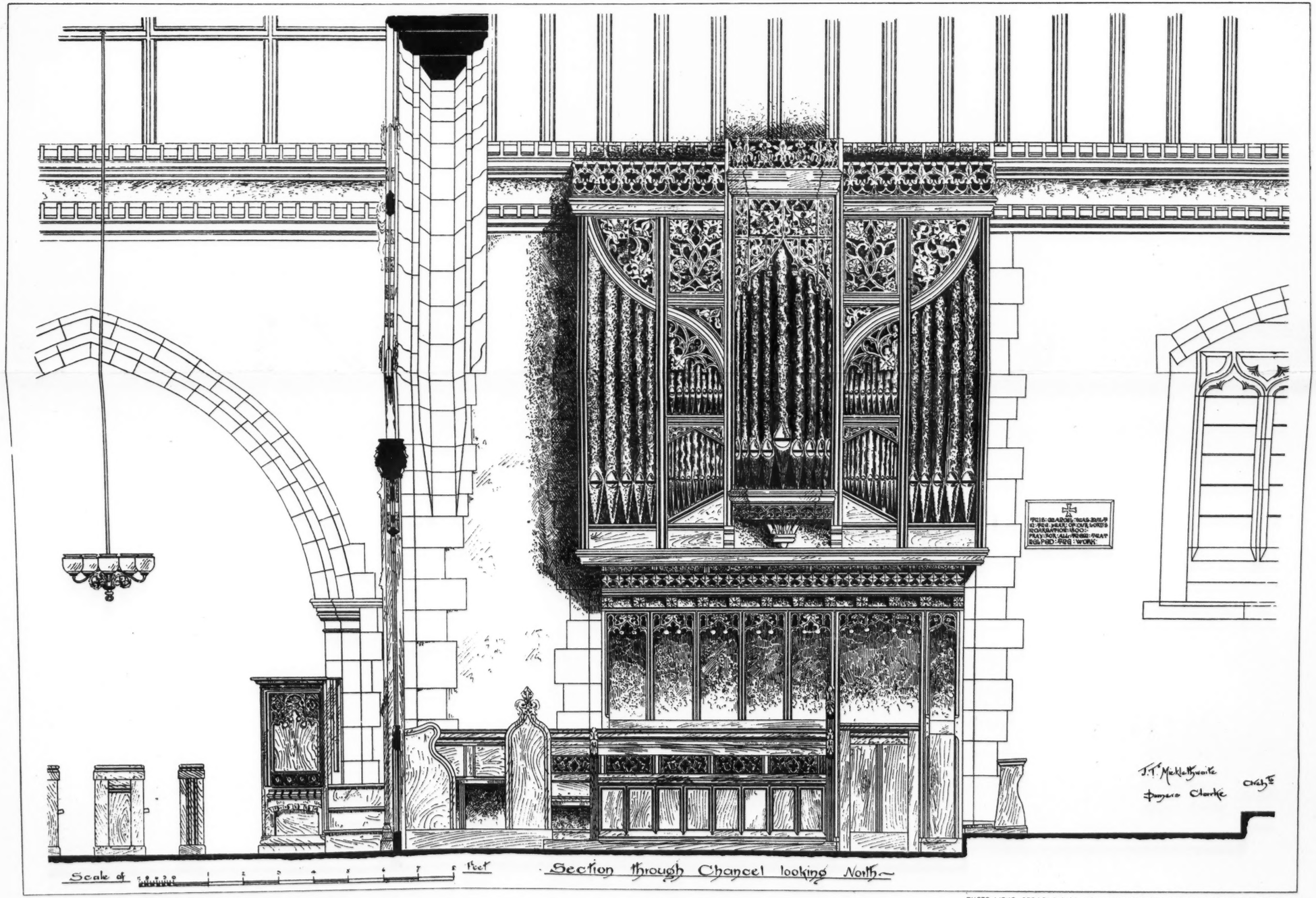
CHANCEL SCREEN, &c., ST. PAUL'S CHURCH, MORTON, GAINSBOROUGH.—MR. J. T. MICKLETHWAITE AND MR. SOMERS CLARKE, ARCHITECTS.



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ORGAN CASE AND STALLS, ST. PAUL'S CHURCH, MORTON, GAINSBOROUGH.—Mr. J. T. Micklethwaite and Mr. Somers Clarke, Architects.

Siena Cathedral.

Part of the marble Mosaic & Graffito paving - North Transept

Note

It will be seen that the pavement is sketched approximately to scale the Memorial tablet thereon being a little larger than the rest

D · O · M

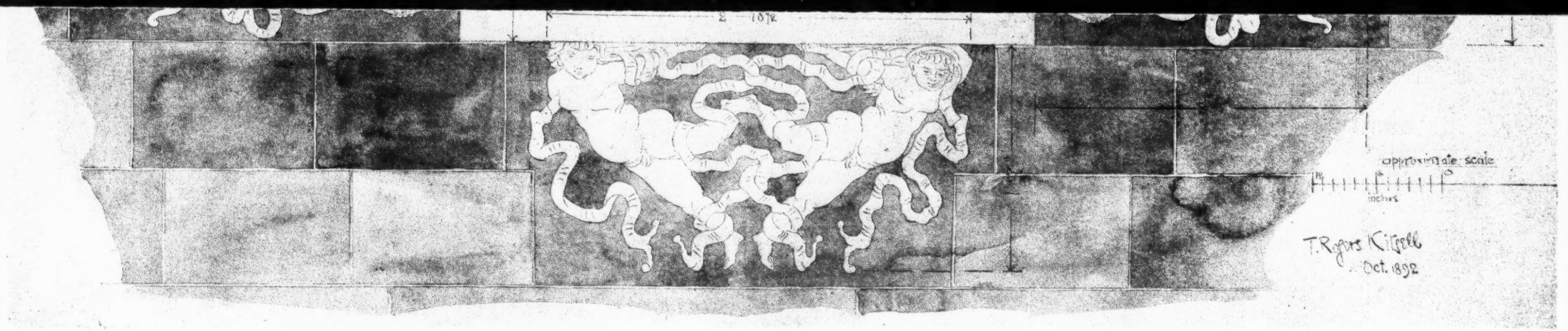
This Tablet with long Latin inscription is reduced here for convenience of drawing. The correct dimensions are figured

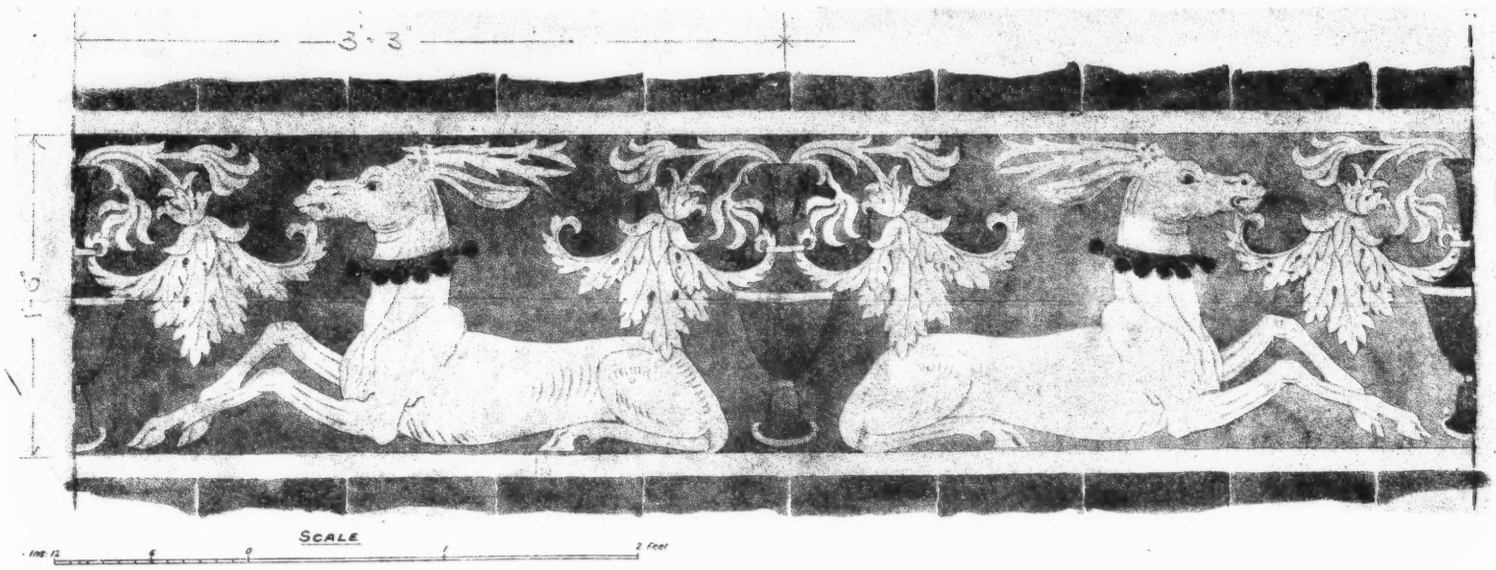
5' 10½"

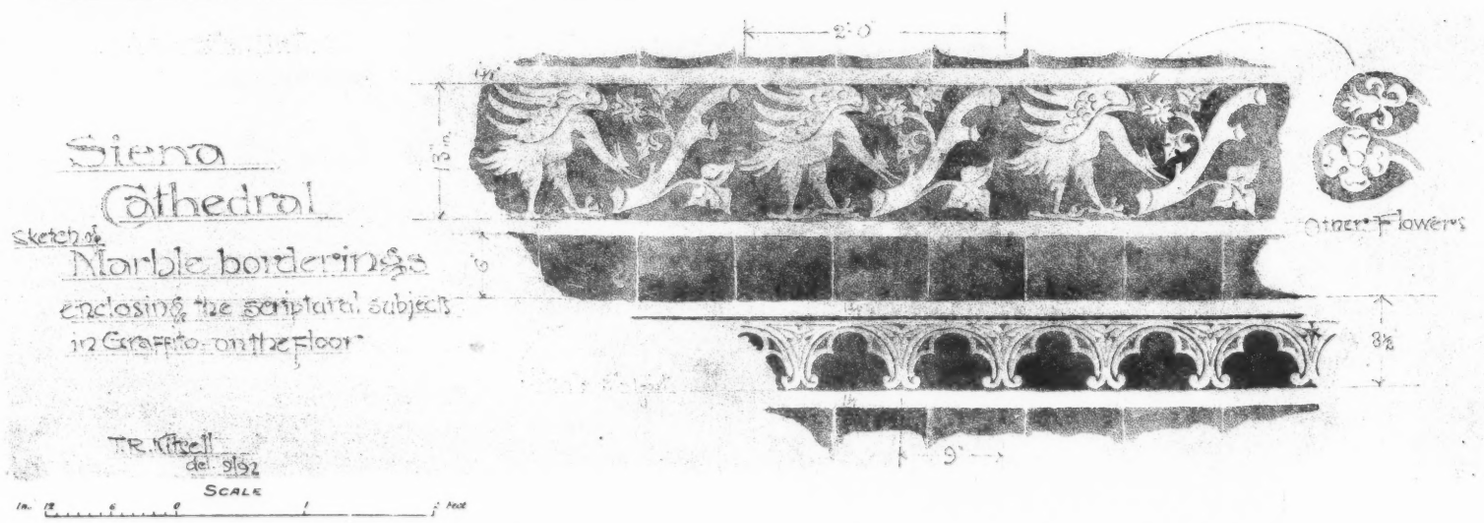
2' 10½"

approximate scale

T. Raffles Kitzell







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DETAILS OF PAVEMENT, SIENA CATHEDRAL.

From Collection of Drawings by Mr. T. Rogers Kitsell, A.R.I.B.A., Soane Medallist for 1892